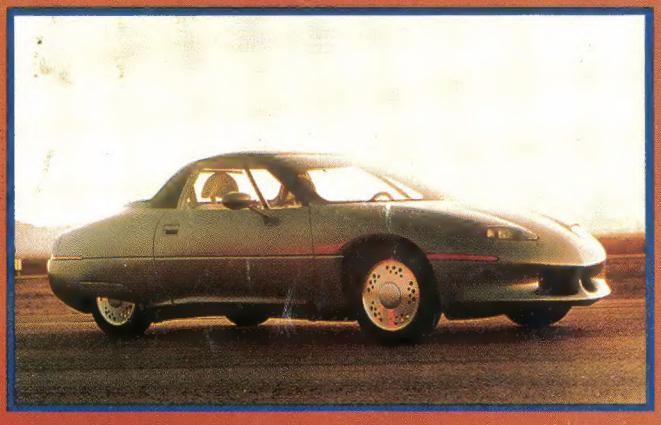
BONUS 116-PAGE ALTRONICS CATALOG

SILICON CHIP

$3.50 FEBRUARY 1991
NZ $4.95 INCL GST

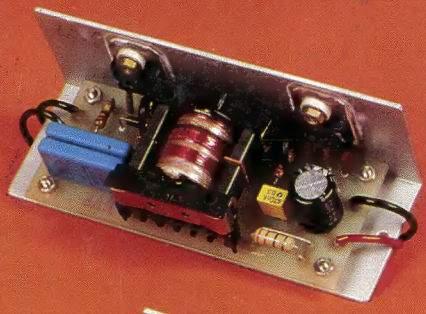
AUSTRALIA'S DYNAMIC ELECTRONICS MAGAZINE

SERVICING — VINTAGE RADIO — COMPUTERS — AMATEUR RADIO — PROJECTS TO BUILD



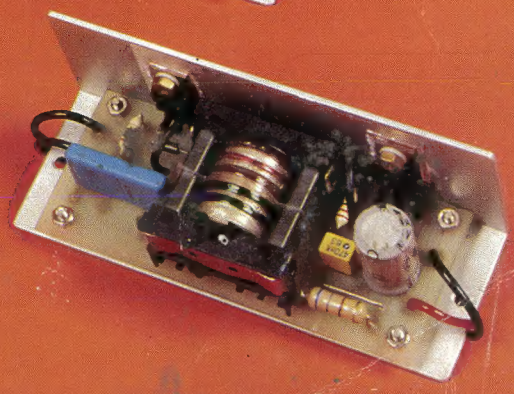
Electric Vehicles:

Practical designs take shape



BUILD THESE:

INVERTERS FOR FLUORESCENT LIGHTS



SYNTHESISED STEREO AM TUNER

David Reid's have the best prices possible. Even one of their competitors seem to think so. Have a look!!!!!

Model 1122 Intergrated Telephone/Answering Machine

Telephone Features:

- ★ Ten easily programmable memories
- ★ Last number redial
- ★ Tone/Pulse switchable dialing
- ★ Pause button
- ★ Three position ringer switch

Answering Machine Features:

- ★ Variable length outgoing message
- ★ Play back of outgoing message
- ★ Voice activated for incoming messages
- ★ Call screening
- ★ LED indicators and tone verifications

12 months warranty

only $129.00

Telecom approved

SUPERCALL CORDLESS TELEPHONE

- ★ 30/39 MHz
- ★ Last number redial
- ★ Mute operation
- ★ 2-way intercom
- ★ Table or wall mounted
- ★ Range approx. 250 mtrs

now $145

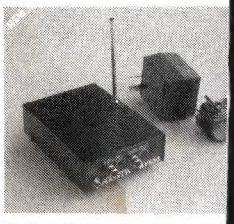
12 months warranty

Telecom approved

AVS30 VIDEO TRANSMITTER

Ideal for watching a video in the bedroom, kitchen etc. with having to move your complete VCR system or having long extension cables runing from one end of the house to the o

- ★ Output channel: UHF30
- ★ Transmitting distance: 10 mtr.
- ★ Complete with connecting cables and power supply.



only $89.95 *D.O.C. approve*

"On-Watch" Wireless Baby Monitor

Transmits all sounds in the room up to 300 ft. away.

normally $99.95

only $69.95

ARLEC Remote Control Door Chime

A portable door chime you can place anywhere in the home. Range: 20 meters.

only $26.95

Multi-Lingual Pocket Translator

Instant word conversion of ENGLISH, FRENCH, GERMAN, SPANISH and ITALIAN.

★ 1400 words per language.

only $49.95

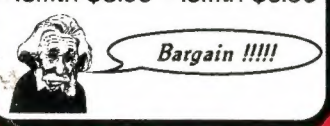
Telephone Extens Bell with 10 mtr. c

This product allows you hear your telephone ring to 10 meters away from existing telephone outle

only $19.95

Telephone Extension Leads .... 4 wire type

★ 5mtr. $6.95 ★ 8mtr. $7.95
★10mtr. $8.95 ★15mtr. $9.95



Water Sensor Alarm

- ★ Water level sensor mounted on a suction cup for easy level adjustment.
- ★ Also has floor water flood sensor on main unit to detect over-spills.

only $9.95

Gas Leakage Detector

- ★ Detects Propane, Butane and Methane gases.
- ★ Inbuilt visual and audible alarm.
- ★ N.O./N.C. output for alarm systems.

$79.95

Heat Detector

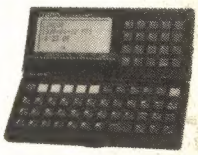
- ★ Fixed temp. @ 60 deg.
- ★ Switch rating up to 30V DC @ 300mA
- ★ No voltage required
- ★ Suit many alarm syste
- ★ Easy to mount

only $9.

CITIZEN ED-3800
ELECTRONIC DIARY

Store Telephone No's, Names and Addresses, Memo function, Schedules, 12/24 hr. Clock and Alarm, World Time, Calender, Calculator, Metric Conversion.

★ 10KB memory. ★ 3 lines with 18 characters.



★ 147 x 62 x 18mm **only $129.95**

CITIZEN ED-4500
ELECTRONIC DIARY

Telephone Directory with Names and Addresses, Calender, Memo, Schedules, Calculator, Metric Conversion.

★ 32KB memory. ★ 6 lines with 13 characters.

★ 132 x 65 x 13mm **only $179.95**

CITIZEN ED-7800
ELECTRONIC DIARY

Telephone Directory, Schedules, Memo, 12/24 Clock with Alarm, World Time, Calender, Metric Conversion, Currency Exchanger, PC Link.

★ 32KB memory. ★ 6 lines with 32 characters.

★154 x 82 x 19mm **only $295.95**

PRECOMPUTER1000 *Junior*

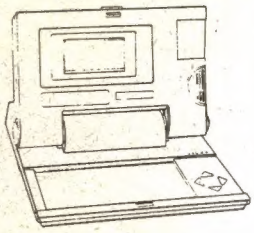
A talking computer that stimulates creative learning

★ **9 "Floppy" Discs** with over 1000 multiple choice questions on Science, History, Health and Safety, Trivia, Maths.

★ **18 Activities** including Spelling, Math, Music, and More !

★ **Multi-Level Games and Quizzes** 1 and 2 player modes.

★ **Large Screen** with animated dot matrix graphics.

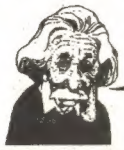


LIMITED STOCKS !!

$99.95

5" PORTABLE "B+W" TV SET with built-in AM/FM RADIO and DIGITAL CLOCK

only $139.95



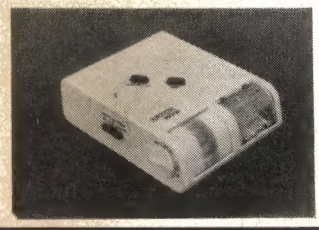
Quality at a low price !

★ 185 x 150 x 150mm
★ UHF/VHF recieption.
★ 240V AC/12V DC operation.

PORTAGUARD
Portable Security Sensor

A portable PIR security system with built-in Alarm/Chime and Light. Take it with you anywhere. E.g. from room to room, take it on holidays to secure your hotel/motel room, caravan or tent. Monitor children, or use it as an automatic light when the user gets up out of bed at night.

Detection distance: 15ft.
View of field: 30deg. horiz.
: 15deg. vert.
Operates on 1 x 9V 216 battery and 2 x AA cells.



$49.95

MS-110 SWR METER for 27MHz

★ SWR Meter
★ Power Meter
★ AM Modulation Meter
★ FM Deviation Meter
★ Antenna Matcher
★ 1watt/10watt/100watt switchable

still $39.95

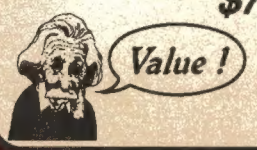
limited stocks be quick!

24KT GOLD SAPPHIRE BLUE AUDIO CABLES

★ 1 RCA x 1 RCA 6' $9.50
★ 2 RCA x 2 RCA 3' $11.00
★ 2 RCA x 2 RCA 6' $12.00
★ 2 RCA x 2 RCA 18" $13.50
★ 2 RCA x 2 RCA 3' $16.00
(with ground terminals)
★ 2 RCA x 2 RCA 6' $19.50
(with ground terminals)

MOUSE MAT

★ 270x220x6mm **$7.95**



Value !

VIDEO LEAD

SCART plug to:
4 x RCA plugs (audio in/out)
2 x BNC plugs (video in/out)

$8.95

WORKSHOP/HOBBY TOOL KIT

Contains:
1 x jewellers screwdriver set
1 x 120mm long nose pliers
1 x 110mm side cutters

only $9.95

David Reid Electronics

127 York Street, SYDNEY 2000
PH: (02) 267-1385
24hr. FAX: (02) 261-8905

MAILORDERS : P.O. Box Q103, SYDNEY 2000
PHONE ORDERS : (02) 267-1385 SAME DAY DESPATCH★

VISA Diners Club International MasterCard

POST & PACKING
$5-$25 ... $3.00
$26-$50 ... $5.00
$51-$100 ... $6.00
$101-$499 $8.00
$500+ ..... FREE

VOLUME 4
NUMBER 2

SILICON CHIP

February 1991

FEATURES

8 Electric Vehicles, Pt.2 *by Gerry Nolan*
Energy storage - an Eldorado for innovators

14 A Practical Approach To Amplifier Design *by David Eather*
How to design the output & driver stages

92 The Story Of Electrical Energy, Pt.7 *by Bryan Maher*
Tasmania's hydroelectric power system

PROJECTS TO BUILD

22 A Synthesised Stereo AM Tuner *by John Clarke*
Features pushbutton tuning & digital frequency readout

46 Three Inverters For Fluorescent Lights *by Otto Priboj*
Use them to run fluorescent tubes from a 12V battery

54 Build A Low-Cost Sinewave Oscillator *by Darren Yates*
Simple circuit can be built from junkbox parts

62 Fast Charger For Nicad Batteries *by John Clarke & Greg Swain*
Pt.2: all the construction details

SPECIAL COLUMNS

37 Computer Bits *by Jennifer Bonnitcha*
Why it takes so long to turn on

40 Vintage Radio *by John Hill*
One thing leads to another

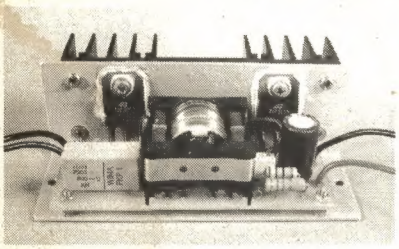
76 Serviceman's Log *by the TV Serviceman*
Now look what ya gorn an' done!

82 Remote Control *by Bob Young*
Galloping ghost & the evolution of proportional control

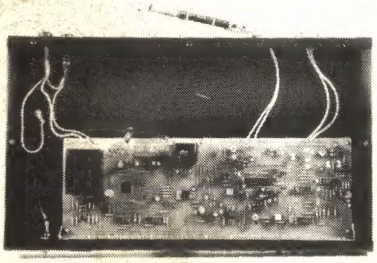
86 Amateur Radio *by Garry Cratt*
Oscillators - which type suits your application?

DEPARTMENTS

3 Publisher's Letter
4 Mailbag
20 Circuit Notebook
58 Back Issues
73 Product Showcase
99 Subscription Page
100 Ask Silicon Chip
102 Market Centre
104 Advertising Index

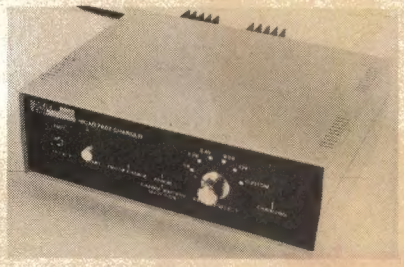


THIS DC-AC INVERTER will let you run a fluorescent lamp from a 12V car battery. There are 3 versions for 16W tubes, 20W tubes & 40W tubes - see page 46.



YOU CAN ENJOY wideband stereo AM sound with this superb new stereo AM tuner. Details page 22.

REVERSED POWER SUPPLIES can cause all sorts of problems in electronic equipment. This month, the Serviceman relates two tales of woe. Turn to page 76.



LAST MONTH, we gave you the circuit details our our new Fast Nicad Charger. This month, we show you how to build it - see page 62

PUBLISHER'S LETTER

Extolling the virtues of fluorescent lights

In this month's issue we are presenting a compact inverter for running fluorescent lights from a 12V battery supply. There are three versions, catering for the very small fluoro tubes, up to those rated at 36W or 40W. We think that they will be popular for people who want to use fluorescent lights on boats, caravans and recreational vehicles, and on homes and farms which are far from the mains supply.

The particular attraction of fluorescent lights in these applications is that they are so highly energy efficient - much better than incandescent lamps.

All of which begs the question as to why fluorescent lamps have fallen so much out of favour as far domestic use is concerned. Why is it so? From our viewpoint, it seems as though there has been a concerted campaign by architects and interior decorators in home improvement magazines to deprecate fluorescent lights. They have been criticised because they put out a "harsh" light and have ugly fittings.

And it is true that most fluorescent tubes do have a bluish light which gives a far from true colour rendition, compared to ordinary daylight. It is also true that most fluorescent light tubes emit a small amount of ultra-violet light which is regarded as undesirable (although it is far less than the amount of UV in daylight.

When it is all added up, fluorescent lights have had a "bad press". It is about time they were put back into perspective. For a start, they are very efficient - about 5 or 6 times more efficient than typical incandescent lamps. They also last about 15 to 20 times longer than incandescents.

But the potential energy and money savings are even bigger when you see the inefficient downlight fittings which are now advocated in kitchens and family rooms. The lamps used in these fittings are not only expensive but they tend to overheat and have a short life.

In fact, it is now not unusual to walk into a modern kitchen which may have 600 to 700 watts of incandescent downlights on and yet still be poorly lit - so much for the vagaries of fashion.

If you compare the cost of operating a twin 40W fluorescent light fitting with an equivalent amount of incandescent lamps (say 400 watts, 15,000 hours, 8 cents per kWH), the potential cost saving is around $600 if you include the cost of replacement incandescent lamps. Which means that the current kitchen lighting fashions are pretty silly.

Leo Simpson

Publisher & Editor-in-Chief
Leo Simpson, B.Bus.

Editor
Greg Swain, B.Sc.(Hons.)

Technical Staff
John Clarke, B.E.(Elec.)
Robert Flynn
Darren Yates

Reader Services
Ann Jenkinson

Advertising Manager
Paul Buchtmann (02) 979 5644
Mobile: (018) 28 5532

Victorian Representative
Hugh Anderson Pty Ltd (formerly McDonald Woodside & Associates Pty Ltd), 119 Market St, South Melbourne, Vic 3205. Phone (03) 696 5411. Contact: Ian McDonald.

Regular Contributors
Brendan Akhurst
Jennifer Bonnitcha, B.A.
Garry Cratt, VK2YBX
John Hill
Jim Lawler, MTETIA
Bryan Maher, M.E., B.Sc.
Jim Yalden, VK2YGY
Bob Young

Photography
Glen Cameron

Editorial Advisory Panel
Philip Watson, MIREE, VK2ZPW
Norman Marks
Steve Payor, B.Sc., B.E.

SILICON CHIP is published 12 times a year by Silicon Chip Publications Pty Ltd. All material copyright ©. No part of this publication may be reproduced without prior written consent of the publisher.

Printing: Magazine Printers Pty Ltd, Rozelle, NSW 2039; Macquarie Print, Dubbo, NSW 2830.

Distribution: Network Distribution Company.

Subscription rates: $42 per year in Australia. For overseas rates, refer to the subscription page in this issue.

Liability: Devices or circuits described in SILICON CHIP may be covered by patents. SILICON CHIP disclaims any liability for the infringement of such patents by the manufacturing or selling of any such equipment.

Editorial & advertising offices: Unit 39, 5 Ponderosa Pde, Warriewood, NSW 2102. Postal address: PO Box 139, Collaroy Beach, NSW 2097. Phone (02) 979 5644. Fax (02) 979 6503.

ISSN 1030-2662

MAILBAG

SILICON CHIP,
PO Box 139,
Collaroy Beach 2097.

The great CD green pen controversy

I am writing regarding "The Great CD Green Pen Controversy", published in the December 1990 issue of SILICON CHIP.

A CD analyser is intended to measure the loss of data caused by physical imperfections on a disc. In order to do so, the mechanism must be extraordinarily accurate and stable to eliminate errors caused by mistracking. Such a mechanism would be very expensive to produce and would not be found in domestic CD players. In this case, a trade-off between cost and performance is made, and so domestic CD players benefit from stabiliser rings and Sorbothane damping, having already a significant interpolation rate due to inadequacies in design. CD ROM players cannot afford to lose large chunks of data and so are more expensive.

A high quality mechanism is unlikely to be affected by stray light and vibration anywhere near as much as a cheaper one. It is therefore no surprise that the green pen apparently made no difference in your tests.

In order to determine whether or not the green pen is effective, it is necessary to modify your experiment. The test should be repeated, if possible, using a standard CD player mechanism connected to the data processor section of a disc analyser. As your test currently stands, you have proved that the green pen does not eliminate physical flaws on a disc. You need a test which demonstrates the effect of the green pen on the tracking accuracy of the scanning mechanism of the average run-of-the-mill CD player. Only then will your data be conclusive.

In support of this argument, it is claimed that damping rings, green pens and Sorbothane feet benefit all players, but that the effect is proportionately less on high quality machines. Note too, that CD Stoplight has produced data obtained from Hewlett-Packard analysers showing an improvement in S/N ratio due to their green pen. Application of the pen dramatically reduces visible reflectivity of the disc, indicating effective absorption of visible light (IR is, however, another matter).

Does it work or doesn't it? The question hinges now on whether you can take an ordinary CD player to Disctronics and hook it up.

P. Edwards,
Ainslie, ACT.

PS: valiant effort, bravo!

Comment: we ain't gonna do any more tests. If you refuse to accept the evidence we have already presented, the chances are that you or other readers will cast doubt on subsequent tests and thereby consider the question still open. And on a practical basis, neither we nor Disctronics Ltd can afford the considerable cost and time involved in these tests.

Having said that, the disc analysers used in the tests were connected to a number of standard CD players. Two of them were "broadcast" machines which differ only in their cueing facilities - in other respects they were bog standard. If you consider that the CD analysers (with supposedly superior tracking mechanisms) showed no improvement with the green pen treatment, then what chance at all is there of any improvement with a cheap CD mechanism?

And although we have not done any tests, we very much doubt whether stabilisers or Sorbothane feet give any measureable or audible improvement to CD players. In our opinion, they come under the same heading of audio quackery.

In a practical sense, we think that audible improvements to CD players can only come from improved digital to analog converters, together with improved digital and analog filtering.

Half a disc better than none at all!

I read with interest your story on "The Great CD Green Pen Controversy" (December 1990 issue).

I too was amazed and sceptical when the adverts for this product appeared but was too lazy (and mean) to buy one and try it for myself. As I expected, your tests show that there is nothing to them.

However, I suspect you will be bombarded by golden-eared experts who will swear they can hear the difference. If the claims made by the manufacturers are true, then a double blind A-B test using identical discs on identical players should show up a noticeable improvement.

I appreciate your comments on the difficulty of obtaining identical discs and players. So how about making the disc act as its own control? Treat *half* of a disc's circumference with the pen, leaving the other half untouched. Then (particularly if the disc chosen is recorded right up to the edge) the laser beam will alternately be swept through an area of maximum "improvement" for half the time, and for the other half will play a reference untreated signal. As the disc rotates at about 500 rpm when playing the outer tracks, the signal should be modulated at about 8Hz by the improvement factor.

If this is as great as the manufacturers claim, there should be an audible - and measurable? - flutter.

Of course, this won't show if the sound is actually improved, only that there is some change caused by putting green ink on the disc edge. My bet is that there won't be any effect whatever.

This is a test anyone can perform in the privacy of his own home, without the expense of complex analysis equipment. And if you can't hear it, it ain't there.

R. Mercer,
Kelmscott, WA.

Perhaps the pen should be another colour?

You missed the point with the CD-XP GREEN pen. It should have been BLUE! Another article perhaps? I enjoyed the one in green very much. Keep up the *excellent* work fellas!

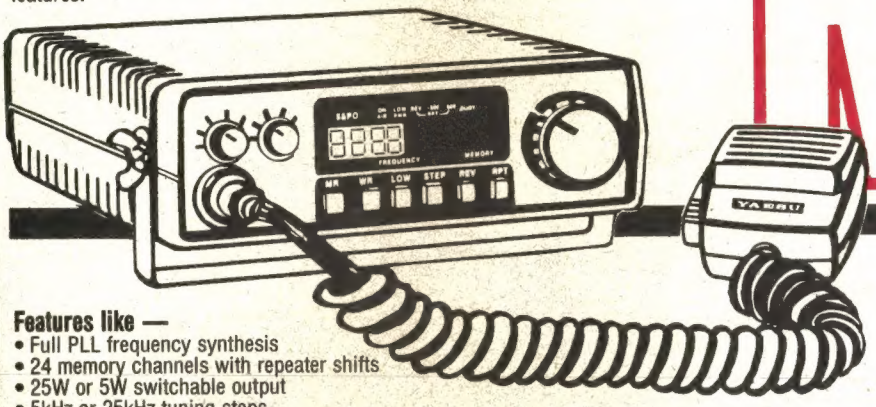
M. J. Vincent,
Golden Beach, Qld.

KITS

Available Soon!

ALL NEW 2M VHF FM TRANSCEIVER

This outstanding high performance FM transceiver can be used as either a mobile or base station on the 144-148MHz amateur band. It must be one of the easiest transceivers of its kind to build yet it comes loaded with advanced features.



Features like —
- Full PLL frequency synthesis
- 24 memory channels with repeater shifts
- 25W or 5W switchable output
- 5kHz or 25kHz tuning steps
- Microprocessor control system
- Excessive SWR safety shut-down circuitry
- 0.15uV sensitivity at 12dB SINAB
- 30kHz selectivity at -60dB
- -60dB image rejection

At this price you can afford to take the challenge! Kit includes all components, hardware, heatsink and a pre-punched silk screened front panel. Microphone is not supplied. YAESU D-2110 or D-2105 are recommended.

Cat K-6400

$399.95

EA Feb '90

NEW!

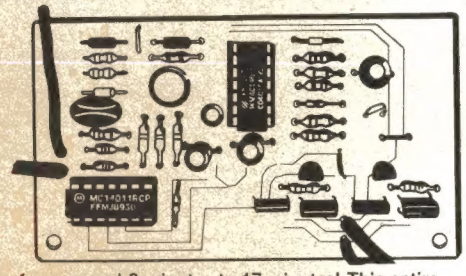
ALARM SIREN MODULE

Need an extra module for your home or car alarm? This is the perfect addition. Some car and house alarms can be disabled simply by cutting the power off. But not this one! It monitors its supply voltage for fluctuations. If the external supply is cut, or varies excessively, the siren is triggered. You can add this module to your existing system or use it as a stand alone unit. (Horn speaker not supplied)

Cat K-8250

$12.95

EA Oct '90



EGG TIMER

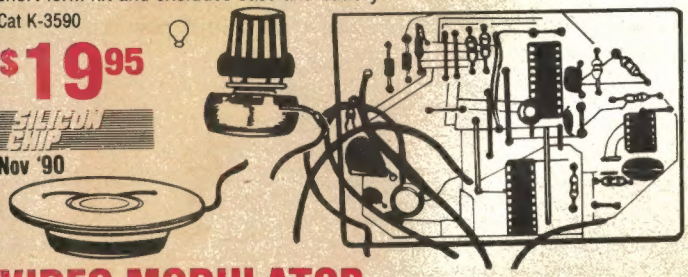
The egg that keeps time — from around 3 minutes to 17 minutes! This entire circuit is designed to fit inside a Pavlova Mix 'egg shell' pack. It even ticks while counting and gives a musical chime when your time is up. This is a short form kit and excludes case and battery.

Cat K-3590

$19.95

SILICON CHIP

Nov '90



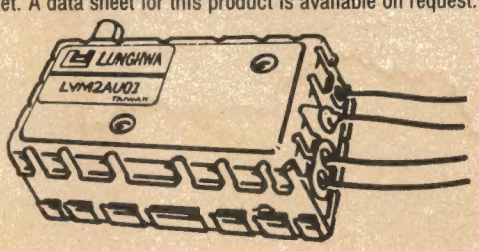
VIDEO MODULATOR

Convert your video or computer output to VHF TV signal with this single module. Comes aligned and pretuned plus it's output is switchable to either VHF Ch.1 or Ch.0. Can be PCB mounted, includes a built-in voltage regulator and RCA output socket. A data sheet for this product is available on request.

Cat K-6043

$9.95

Originally $19.95!



TRANSISTOR TESTER

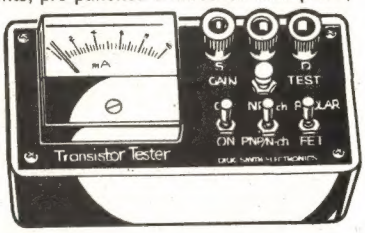
This low cost instrument will become an invaluable piece of your test equipment!
- Tests bipolar transistors, diodes, F.E.T.s, S.C.R.s & P.U.I.s
- Powered by a 9 volt battery (not supplied)
- Includes 50mm meter, all components, pre-punched & screened front panel, and case

Cat K-3052 EA July '78

$39.95

Was $46.95 Before Christmas!

Limited Stocks!



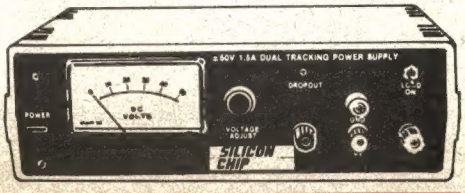
DUAL TRACKING +/- 50V POWER SUPPLY

SILICON CHIP

This switch mode power supply can really deliver the goods with variable output from 0 to 100 volts DC! Ideal for TV servicing.
- Current output is 1.7A @ 0-87V & 1A @ 100V
- Voltage is variable from 0-100V
- LED indicator for ripple exceeding 5mV p-p
- Short-circuit protected
- Pre-punched & screened front panel
- This kit is supplied complete

Cat K-3465

$249.95



Kits marked with this symbol involve mains power wiring. Take extreme care when working with this equipment.

Degree Of Simplicity Simple Intermediate Detailed

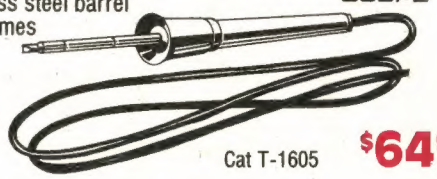
DICK SMITH ELECTRONICS

TOOLS

SCOPE SOLDERING IRONS

150 Watt Superscope

Select the temperature you want and the Superscope will deliver it from cold in just 6 seconds! Uses a non-corrosive stainless steel barrel for longer life and comes with a spare tip and element. Requires a 3.3V @ 30A transformer Cat T-1692.

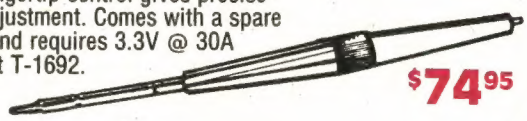


Cat T-1605 **$64.95**

10-70 Watt Miniscope

Lightweight, fingertip control gives precise temperature adjustment. Comes with a spare tip & element and requires 3.3V @ 30A transformer Cat T-1692.

Cat T-1660

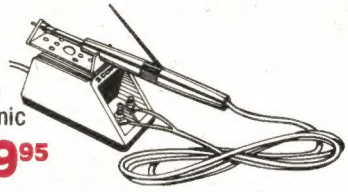


$74.95

3.3V @ 30A Transformer

A low voltage transformer for Scope soldering irons. Includes an electronic shield for extra protection.

Cat T-1692 **$79.95**



12 Volt Superscope

A 30-150 watt iron that connects to your car battery and heats in just 3 seconds! Comes with a 6m lead with alligator clips. Current drain is 45A.

Cat T-1635 **$84.95**

Replacement tip packs

T-1601/3 **Only $10.95**

SCREWDRIVER BIT SET

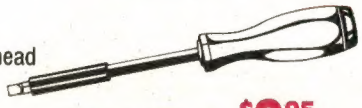
Push-Action

- 6 & 8mm flat blades
- No.1 & 2 Phillips heads
- 2 hole reamers

Cat T-4512 **$9.95**

Magnetic

- Fully insulated with magnetic head
- 4.5 & 6mm flat blades
- No.1 & 2 Phillips heads
- No.1 & 2 Pozidrive heads



Cat T-4505 **$9.95**

5 Bit Set

- Large rubber handle for extra grip
- 1.2, 6, 6.5 & 7mm flat blades
- No.1 & 2 Phillips heads

Cat T-4500 **$5.95**

Universal Bit Set

- For manual or electric drivers
- 4.5 & 7mm flat blades
- No.1 & 2 Phillips heads
- No.1 & 2 Pozidrive

Cat T-4518 **$3.95**

T-Bar Magnetic Screwdriver

- With 6 magnetic bits & plastic holder
- 2 Phillips, 2 flat, and 2 Torx bits

Cat T-4515 **$5.95**

Heat 'n Strip Gun

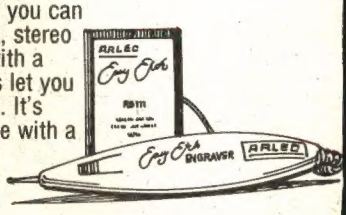
A great tool to have around the house. Ideal for heatshrink work, removing old paint, drying... you'll find hundreds of uses for the Arlec Heat 'N Strip gun. It's mains operated & light and easy to use.

Cat T-4845 **$59.95**

Easy Etch Engraver

With the Arlec Easy Etch Engraver you can easily and quickly mark your tools, stereo equipment and household goods with a permanent identification. Steel bits let you engrave on metal, plastic, or wood. It's easy to handle and comes complete with a 12V plug pack and long cord.

Cat T-4753 **$39.95**

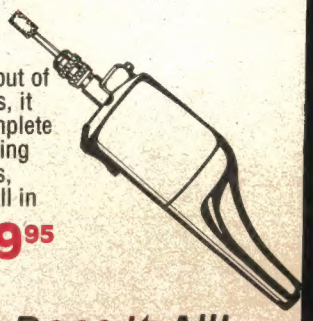


Perfect For PCB Work!

ARLEC Supertool

The Arlec Supertool takes the hassle out of working on PCB's. It sands, it polishes, it drills, it engraves, it mills. Comes complete with wire brush, milling cutters, grinding wheel, high speed drills, chuck collets, eraser sticks and plug pack adaptor-all in a handy carry case.

Cat T-4754 **$79.95**



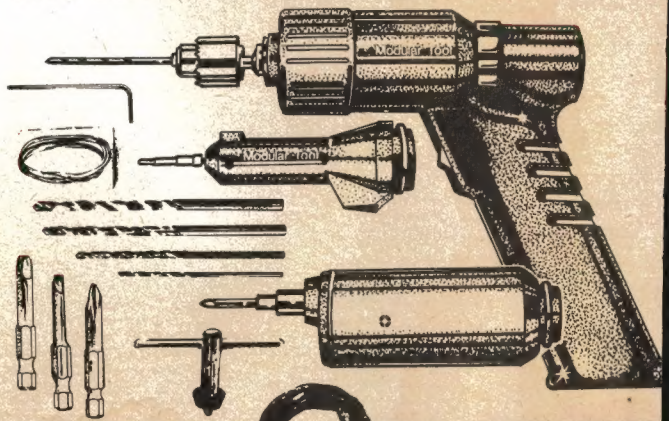
The One Tool That Does It All!

3-IN-1 Modular Tool

- It's a drill plus drill bits
- It's a Soldering Iron plus solder
- It's a Screwdriver plus drivers
- And it's rechargeable too!

Cat T-5712

Unbeatable value at $79.95



DICK SMITH ELECTRONICS

B1088/

MADE IN USA

3 YEAR WARRANTY!

Fluke 73

Uncompromised quality at an affordable price. The superb autoranging FLUKE 73 is just the thing to withstand the rough and tumble of everyday use.

- 3.5 digit, 3200 count multimeter
- 31 segment bargraph
- Autoranging & automatic polarity
- High energy overload protection
- Every feature on one rotary dial!

Cat Q-1602 **$179**

Fluke 75

With all the features of the FLUKE 73 plus diode and audible continuity testing!

- 3.5 digit multimeter
- 31 segment bargraph
- Autoranging & automatic polarity
- Audible continuity testing
- Diode test
- Dirt and moisture resistant case

Cat Q-1604 **$289**

The Incredible Fluke 87

You'll wish that all your test equipment could perform so well, last so long, and give you so much flexibility!

- 4.5 digit & Analogue Bargraph readout
- Auto & manual ranging
- Frequency & true RMS
- Capacitance
- Min/max average recording
- Overload protection
- Continuity & diode testing
- Touch hold
- Back-lit display plus lots more!

Cat Q-1610 **$699**

Fluke 77

The feature packed FLUKE 77 is the top of the line 70 series multimeter with advanced features like Touch Hold and superior accuracy (0.3% for 3.2 to 320V).

- Autoranging & automatic polarity
- 3.5 digit plus 31 segment bargraph
- Touch Hold with 'beep' indicator
- Continuity & diode test
- Superior accuracy across most ranges
- Hand carry holster

Cat Q-1606 **$399**

Genuine Fluke Accessories

Universal Temperature Probe

A P-N junction probe. Converts any DMM to a thermometer. Air, surface and liquids from -50°C to 150°C. Switchable °C and °F.

Cat Q-1680 **$279**

Air Probe

For air and other gases. Protected probe with perforated stainless steel baffle. Range: -196°C to 816°C.

Cat Q-1686 **$119**

Immersion Probe

For liquids and gels. Fully protected by Inconel sheath. Range: -196°C to 927°C.

Cat Q-1684 **$89**

High Voltage Probe

Extends your measurement capabilities up to 40K volts using a division ratio of 1000 to 1.

Cat Q-1690 **$199**

AC Clamp Meter

Hall-effect clamp metre accessory with its own battery. Measures currents from 1 to 400A and fits conductors up to 30mm dia.

Cat Q-1670 **$159**

AC/DC Clamp Meter

Battery powered Hall-effect meter for conductors up to 30mm dia. Measures currents from 5 to 400A at frequencies up to 400Hz.

Cat Q-1672 **$299**

Deluxe Test Lead Kit

Standard shrouded banana plug leads with interchangeable tips in a soft carry pouch. Comes with alligator clips, spade lugs, standard pointed tips, and one retractable hook tip.

Cat Q-1658 **$59.95**

Industrial Test Lead Set

1.6m silicon insulated test leads with interchangeable stainless steel test probes and safety alligator clips.

Cat Q-1652 **$79.95**

Soft Case

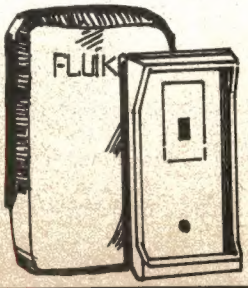
Protective case for FLUKE meters. With water resistant zipper and pockets for leads. Even fits FLUKE holster!

Cat Q-1664 **$49.95**

Holster

With lead and probe pouch plus tilt stand and belt hook. Suits any of the FLUKE 70 series DMMs.

Cat Q-1663 **$32.95**



Store Locations

NSW • Albury 21 8399 • Bankstown Square 707 4888 • Blacktown 671 7722 • Brookvale 905 0441 • Bondi 387 1444 • Campbelltown 27 2199 • Chatswood Chase 411 1955 • Chullora 642 8922 • Gore Hill 439 5311 • Gosford 25 0235 • Hornsby 477 6633 • Hurstville 580 8622 • Kotara 56 2092 • Liverpool 600 9888 • Maitland 33 7866 • Miranda 525 2722 • Newcastle 61 1896 • North Ryde 878 3855 • Parramatta 689 2188 • Penrith 32 3400 • Railway Square 211 3777 • Sydney City 267 9111 • Tamworth 66 1711 • Wollongong 28 3800 • **ACT** • Belconnen (06) 253 1785 • Fyshwick 80 4944 • **VIC** • Ballarat 31 5433 • Bendigo 43 0388 • Box Hill 890 0699 • Coburg 383 4455 • Dandenong 794 9377 • East Brighton 592 2366 • Essendon 379 7444 • Footscray 689 2055 • Frankston 783 9144 • Geelong 232 711 • Melbourne City 399 Elizabeth St 326 6088 and 246 Bourke St 639 0396 • Richmond 428 1614 • Ringwood 879 5338 • Springvale 547 0522 • **QLD** • Brisbane City 229 9377 • Buranda 391 6233 • Cairns 311 515 • Chermside 359 6255 • Redbank 288 5599 • Rockhampton 27 9644 • Southport 32 9033 • Toowoomba 38 4300 • Townsville 72 5722 • Underwood 341 0844 • **SA** • Adelaide City 223 4122 • Beverley 347 1900 • Elizabeth 255 6099 • Enfield 260 6088 • St. Marys 277 8977 • **WA** • Cannington 451 8666 • Fremantle 335 9733 • Perth City 481 3261 • Midland 250 1460 • Northbridge 328 6944 • **TAS** • Hobart 31 0800 • **NT** • Stuart Park 81 1977

DICK SMITH ELECTRONICS

Electric Vehicles

Pt.2: energy storage

By GERRY NOLAN

When you consider that one kilogram of petrol stores the equivalent of 12,000 watt-hours of energy, any electric storage medium falls a long way short. The best alternative is the aluminium-air fuel cell which has an energy density of up to 360 watt-hours per kilogram, so it is obvious that the field of energy storage is wide open to innovation.

The size, weight, shape and technical characteristics of the energy source affect almost every other vehicle attribute. Energy density is the most important consideration but choice of the energy source will depend on a host of factors including: power density, cycle life, initial cost, maintenance cost, energy efficiency, output voltage, internal impedance, charge rate, byproducts, shelf life, temperature characteristics and overall safety. However, energy density is what really matters.

This is simply the total source energy divided by the source weight to give a result in watt-hours per kilogram (Wh/kg). Naturally, the source weight must include any subsystems required by the source, such as cooling fans and so on.

Table 1 shows the energy densities of various fuels and other energy sources and makes it clear how very low the energy densities of man-made sources are.

The values listed are nominal and may vary considerably under certain conditions but the much lower energy densities of the man-made sources relative to the natural sources are obvious.

It is also important to realise that energy density may vary considerably with the rate at which the energy is used.

For example, an energy density of 60Wh/kg may be claimed by the manufacturer of a particular type of battery weighing 30kg, so we would expect to obtain 1800Wh of energy. What the manufacturer may neglect to tell us, however, is that if we use the energy at double the normal rate, the energy density drops to 45Wh/kg, giving us a total energy availability of only 1350Wh.

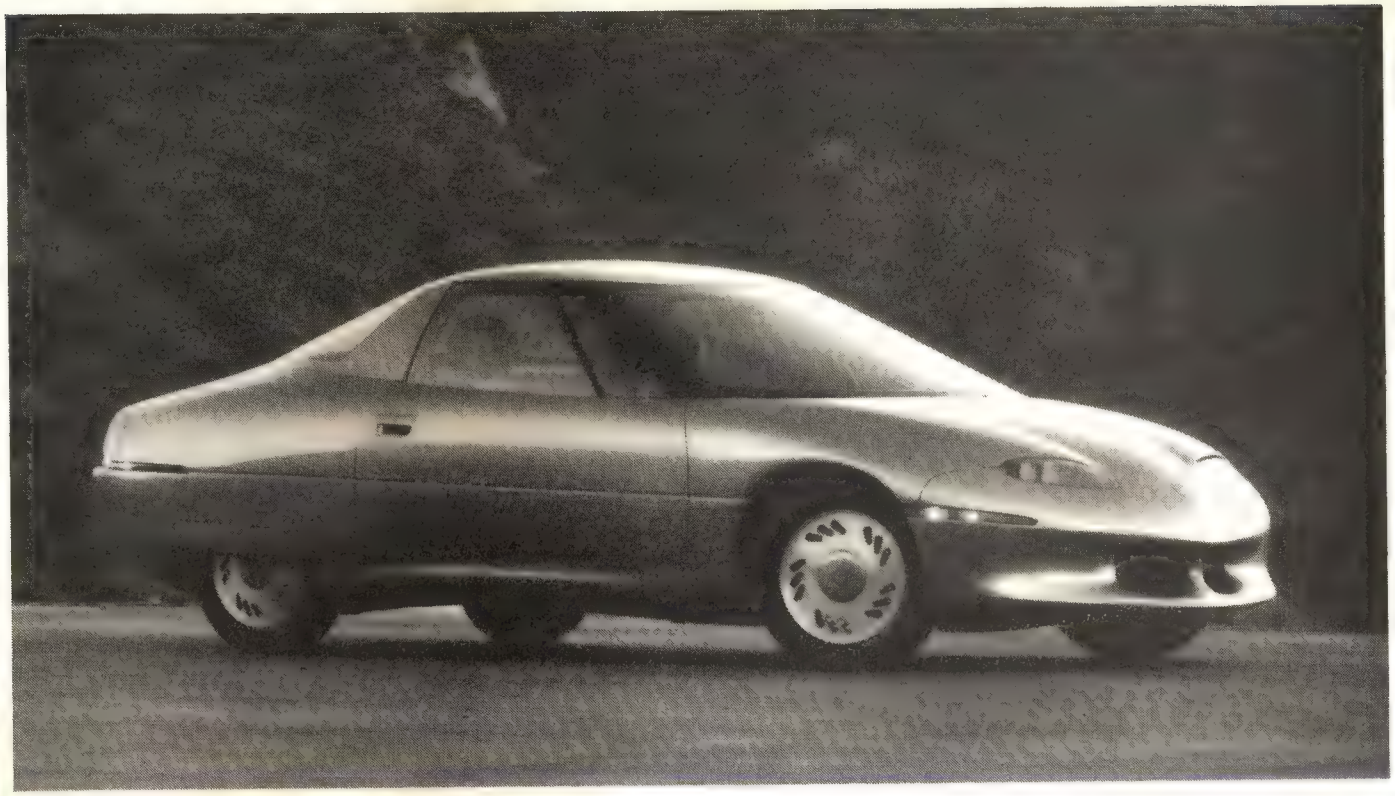
The moral of this, of course, is to specify energy density at a specific power level.

As anyone reading this article probably already knows, the most common energy source for electrical vehicles is the lead acid cell. The currently obtainable energy densities of these is up to 50Wh/kg. Other batteries, fuel cells and flywheels are shown in Table 2 along with their theoretically obtainable energy densities.

Power density vs acceleration

An energy source with a very high energy density is highly desirable but, as with conventional engines, the rate at which the energy may be used is also very important. This rate is determined by the power density which is measured in watts per kilogram.

A good example of a battery with a high energy density but a low power density is the aluminium-air fuel cell developed by Alupower in Ontario, Canada. Because it takes up to half an hour to reach its full power capacity, it needs to be used with lead acid cells which supply short term demands.



THE GENERAL MOTOR'S IMPACT car uses high-power sealed-lead acid batteries & shatters the perception that electric vehicles are slow-moving golf-buggies. During trials, it beat a Nissan 300ZX in 0-100km/h acceleration tests.

Power densities of up to 150W/kg may be obtained from lead acid batteries, around 200W/kg for nickel zinc, 100W/kg for nickel iron, 65W/kg for zinc chloride, 160W/kg for lithium iron and up to 200W/kg for sodium sulphur. On the basis of this comparison, the ordinary lead acid battery isn't too bad.

Replacement cost

How many times can you charge and discharge (cycle) the batteries before they have to be replaced? The General Motors Impact car is designed to be powered by 32 10-volt batteries. These have an expected life of about 40,000km and a replacement cost of around $3500, or a little less than nine cents per kilometre. This is a much higher cost than the energy itself, which could be taken from the power grid for as little as 0.3 cents per kilometre.

Increasing cycle life will obviously reduce the replacement cost per kilometre and research over the past decade has greatly improved the number of cycles possible, in some cases almost doubling it. Now lead acid batteries have a cycle life approaching 800 cycles, up from 500 in 1980, while nickel iron and sodium sulphur may be cycled (ie, fully charged and fully discharged) more than a thousand times.

Another factor which needs to be taken into consideration when selecting an energy source is cell voltage, which will determine how many cells need to be hooked up and the type of array to obtain the voltage necessary to run the motor and battery efficiently. The available voltage will also be affected by the internal impedance, which generally increases as charge decreases.

Battery maintenance is also an important consideration from time, material costs and skills points of view - your average EV user may not feel too comfortable topping up the battery with some exotic electrolyte every second day.

Flat batteries

One of the things that will worry EV users, at least until there are enough recharging stations handy, is the fear of the batteries going flat without warning. In your present vehicle, a glance at the fuel gauge and a quick mental calculation will enable you to work out roughly how far you can go before you need to stop for fuel.

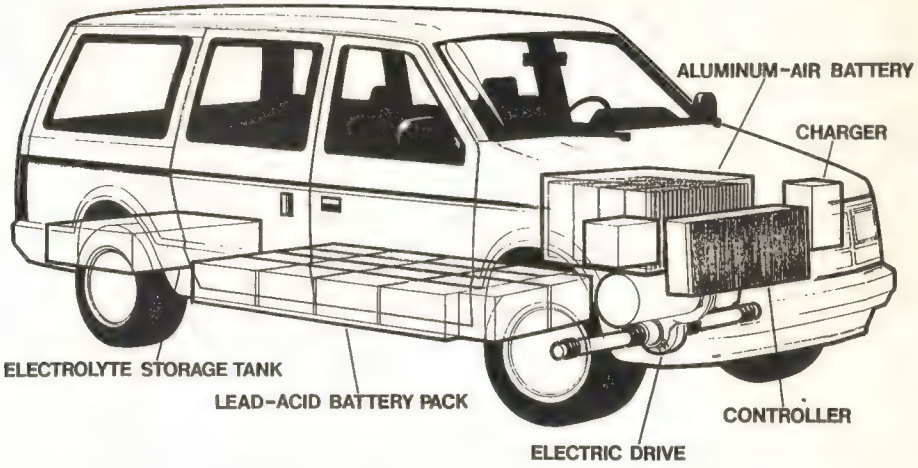
However, replacing the fuel gauge

Table 1

Energy Source	Nominal Energy Density (Wh/kg)
Petrol	12,300
Natural gas	9,350
Methanol	6,200
Hydrogen	28,000
Coal	8,200

Lead-acid battery: up to 50
Sodium-sulphur battery: 150-300

n Eldorado for innovators



ALUMINIUM-AIR HYBRID ELECTRIC PROTOTYPE - because the aluminium-air battery takes half an hour to build up to peak power, a lead-acid battery pack is used to supply start-up and acceleration energy. Excess energy from the Al-air battery can then be used to recharge the lead-acid pack while the vehicle is moving.

with a "charge gauge" is not such a simple matter in an electric vehicle. The definitions of a fully charged battery and the way to measure its charge vary considerably with the type of battery.

The no-load voltage level may give a reasonable indication in some cases but will vary with the history of the battery, temperature and so on. Measuring the electrolyte specific gravity also gives an indication but few EV users would appreciate the inconvenience.

A type of "charge gauge", which integrates the current into and out of the battery to give an actual state-of-charge, would be a great comfort. An additional selling point would be a "range-at-present-speed" readout.

Charge acceptance

The capability of the energy source to take a charge is also an important consideration, as it should be able to absorb high rates of energy input (eg, under regenerative braking) without exceeding acceptable temperature levels.

Nickel-cadmium batteries, in particular, are able to handle high charge rates and Audi is using these in a hybrid 4-wheel drive car.

The front wheels of the "duo" are driven by the normal Audi 2.3 litre, 5-cylinder petrol engine and the rear wheels by a pack of 49 nicad cells, each of 1.2 volts, powering a 9.4kW electric motor which fits into the transmission tunnel.

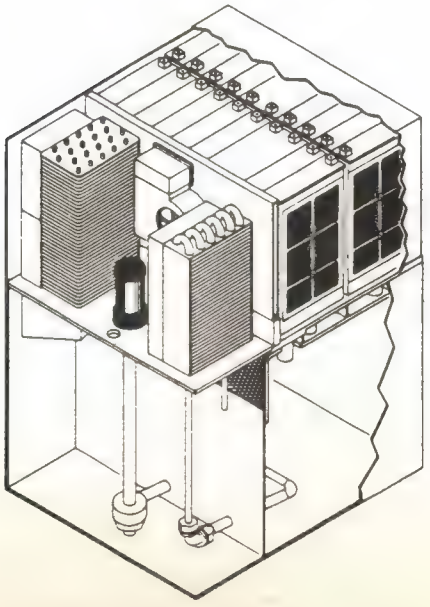
Safety considerations

The sheer weight of batteries, especially when lead acid cells are used, requires special strengthening in the design and construction of EVs from scratch or when converting conventional vehicles to EVs or hybrids. 400kg of batteries suddenly coming loose during a crash stop would be a major hazard, to say the least.

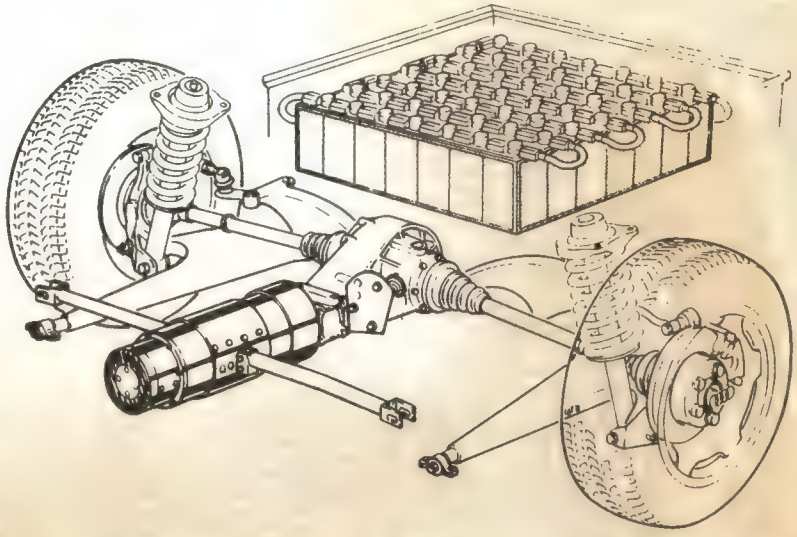
"Gassing" and high temperatures during charging can also lead to problems, particularly at high rates of charge, and effective ventilation must be built-in.

Silver zinc batteries

Twelve of the first 13 cars in the recent World Solar Challenge used silver zinc batteries, while roughly the same number of vehicles used



ALUMINIUM-AIR CELL - an aluminium-air cell usually has 20 individual cells, a condenser and a heat exchanger at the centre of which are located the pump motor and air blower. The condenser removes oxygen depleted air from the system and the heat exchanger keeps the electrolyte temperature at about 60°C. The blower circulates air through the cathodes.



DUAL POWER FOR AUDI - a 180kg, high performance nickel-cadmium battery pack fits into the spare wheel-well of the Audi 100 to power the 9.4kW electric motor which fits into the transmission tunnel. Because the petrol engine is retained to drive the front wheels, a 4WD vehicle with two completely independent drive systems is the result.

lead acid batteries. Although they are much more expensive than lead acid batteries, with their high energy density (100Wh/kg), superior power density and lighter weight, silver zinc batteries give an electric vehicle a decided performance advantage.

So far we've talked mostly about batteries and their close relatives, fuel cells, but flywheels have been around for a long time, much longer than batteries in fact, and could conceivably have even greater potential than batteries or fuel cells as energy storage systems for EVs.

Flywheel research

Your silky smooth BMW, Mercedes, even the Rolls, would run very roughly, if at all, without a flywheel to maintain the crankshaft rotation through to each ignition stroke.

Apart from smoothing out the staccato power delivery of the piston engine, flywheels have also been used in vehicles for energy storage since the 1930s in everything from torpedoes to draglines and helicopter hoists. Archaeologists have found one in the Middle East that they believe was used as a potter's wheel in ancient Ur of Chaldea 5,500 years ago. As far back as 1973, researchers were predicting energy densities of 870 watt-hours per kilogram using fused silica as a material for super flywheels.

What some people didn't seem to realise until much more recently was that, while the energy storage capacity is directly proportional to the mass, it is proportional to the *square* of the rotational velocity - so triple the speed of rotation and you get nine times the energy storage capacity. Concentrating the mass near the circumference, where the rotational velocity is highest, also increases the energy storage capacity for a given overall weight.

For a time, lightweight high-speed flywheels appeared to have real potential and a great deal of research was carried out during the early 70s when the Middle East put up oil prices. Unfortunately, when oil prices dropped again, flywheel research lost its momentum.

Now, although research is gaining speed again, the high expected energy densities haven't materialised. Nevertheless, the availability of light, high-tensile fibres such as Kevlar, magnetic levitation bearings, high vacuum enclosures and electronic commutation and control have enabled densities of more than 40 watt-hours per kilogram to be obtained.

Because they are so light, relatively maintenance free and could be made

Table 2

Source	Energy Density (Wh/kg) Now Available	Theoretical
Lead acid	50	110
Nickel zinc	90	
Nickel iron	60	
Nickel cadmium	30	
Silver zinc	100	500
Zinc chlorine	90	
High Temperature Batteries		
Lithium metal sulphide:	170	
Sodium sulphur:	300	
Fuel cells		
Aluminium air:	350	
Flywheel (steel):	12-30	
Super flywheel (fibre):	up to 40	870

Exotic Energy Storage For EVs

Zinc-hydroxide, aluminium-air, vanadium and sodium-sulphur electro-chemical batteries and fuel cells, some being recharged simply by replacing the electrolyte, are all current areas of research.

Energy densities of up to 200Wh/kg are being claimed for the zinc-hydroxide electrochemical cells which are being researched by a team headed by Jim Evans at the Lawrence Livermore Laboratories near San Francisco.

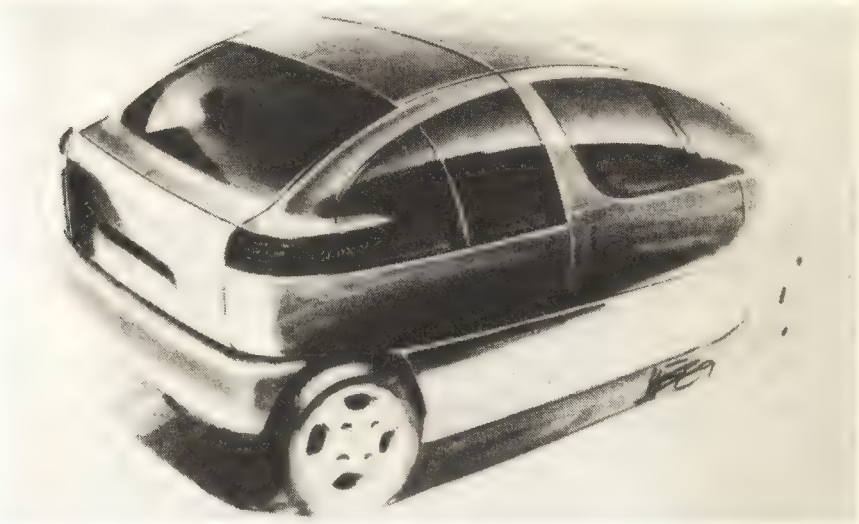
Zinc is often used as a material for electrodes - remember the zinc-copper-acid cell we all experimented with at school? - but it is generally in the form of a sheet or slab. By using the zinc as particles, the slurry of anode and electrolyte can be continuously replaced from a reservoir with the used material being stored for later replacement and recycling at a "service station".

The aluminium-air cells being developed by Alupower have a claimed energy density of 360Wh/kg. Alupower is an Alcan subsidiary which is combining its technology with Moli Energy's rechargeable lithium battery knowledge.

Alupower's fuel cell generates electricity by an electrochemical reaction between aluminium and oxygen, using an alkaline solution or saltwater as an electrolyte. An air stream is blown through the cell stack to supply the oxygen for the electrochemical reaction, while the electrolyte is pumped through the cell stack between the aluminium anodes and air cathodes.

Electricity is produced as the aluminium oxidizes, forming aluminium hydroxide as a byproduct which precipitates out and is collected in a sump. This can be collected and recycled back into aluminium, making it a clean and non-polluting renewable power source (see illustration).

Some of these research paths will be blind alleys, others will lead to developments in directions quite different from that originally intended, but that is the way of research.



THE CLEAN AIR TRANSPORT LA301 - a 4-passenger or 2-seat microvan - uses lead-acid batteries & an aluminium-air fuel cell to power an 11.9kW DC motor. It also has a propane-fuelled auxiliary power unit to achieve a maximum range of 240km and a top speed of 100km/h.

EXPERIMENTAL ELECTRIC vehicles have been produced in Australia. This one is a converted Mazda utility powered by a 10kW forklift motor & a 48V battery bank. Solar cells on the roof top up the batteries during the day.

for change over at service stations instead of waiting for a recharge, the possibilities for fruitful research are very high.

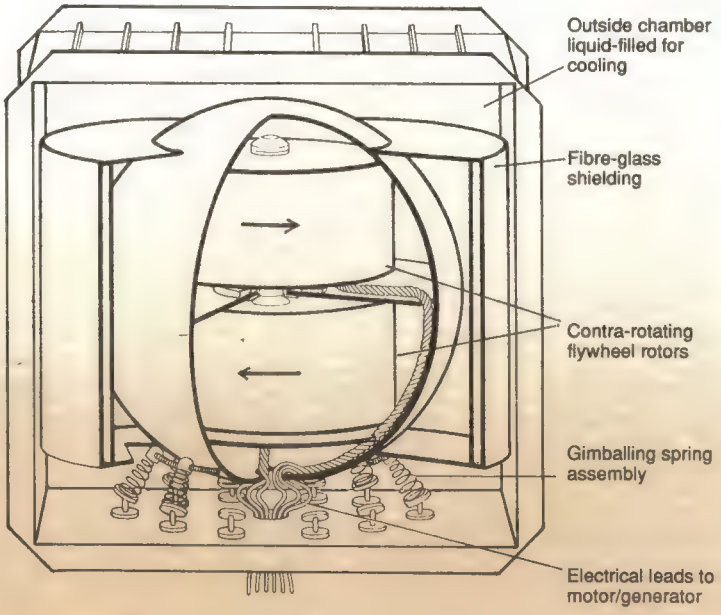
Another advantage of the lightweight fibres is that if the flywheel disintegrates, perhaps because of overspeeding, it just becomes a pile of fluff instead of potentially lethal chunks of high grade steel.

Where are we going?

One of the mistakes EV designers and builders seem to be making is to compete head on with existing family cars by designing for ranges of at least 100km at speeds up to 100km/h.

You may remember from last month's article that 90% of all daily one way trips are less than 35km long. So why not design for a trip range of 50km at speeds of up to 80km/hr, at least until the technology is more widely accepted.

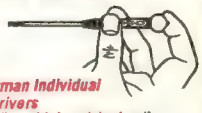
For a start, this would reduce battery weight to less than half. Less than half? Yes - with a lighter battery load and the consequent reductions in strengthening required - the overall vehicle weight would be much less and not so much energy would be required to push it around. The combined results would be reduced manufacturing, running and maintenance costs, making EVs a much more immediately attractive alternative, thereby greatly accelerating their acceptance by the public. **SC**



THE ADVENT OF THE "ENERGY WHEEL" - an energy pack of super flywheels built as a combined motor/generator with electronic commutation and magnetic levitation bearings, running in a high vacuum, would provide very efficient energy storage. Because of the enormous speed at which the flywheels rotate, the energy would be used to power an electric motor to drive the wheels, rather than using a mechanical drive train. The pack would be self-contained so that it could be quickly replaced by a fully charged one when discharged. Flywheels used for energy storage in moving vehicles would need to be contra-rotating and gymballed to dampen out gyroscopic precessing forces.

TOOL BOX

If you want to do a good job, use the right tools! This month we're featuring our extensive range of tools for professionals and hobbyists alike. Call in and check out your requirements. We're bound to have what you want. Take screwdrivers for example –



C K German Individual Screwdrivers

Super-slim with burnished anti-chrome peeling tips. Ball end with guiding point. Full control for tightening and loosening small screws.

Flat	2.5x60mm	$5.95
	2.5x75mm	$6.60
	3.0x100mm	$6.60
	3.0x150mm	$6.60
	4.0x100mm	$6.60
Philips	PH 0x60mm	$11.50
	PH 1x80mm	$11.20

C K German Watchmakers 6 Screwdriver Set

Flat 0.75mm, 1.4mm, 2.0mm, 2.4mm
Philips PH 00, PH 0 **$18.50**

C K German Extra Long

255mm Philips Screwdriver PH 1 **$8.25**

C K German Precision Screwdriver Set

As above. Contains the handy sizes
Flat 1.5x60mm, 2.5x75mm, 3.0x100mm
Philips PH 0x60mm **$23.50**

WITTE Power Drill Screwdriver sets

Use these with any electronic (speed controlled) power drill.

30591 Universal Holder With Magnet and 7 bits
Pozidriv PD 1, PD 2
Philips PH 1, PH 2
Flat 4x0.5mm, 5.5x0.8mm, 6.5x1.2mm **$20.25**

30587 Universal Holder With Magnet **$11.25**
30594 Pozidriv Bit Pair PD 1 **$3.75**
30595 Pozidriv Bit Pair PD 2 **$3.75**
30598 Philips Bit Pair PD 1 **$3.75**
30602 Flat Bit Pair 4.0x0.5mm **$4.75**
30604 Flat Bit Pair 5.5x0.8mm **$4.75**

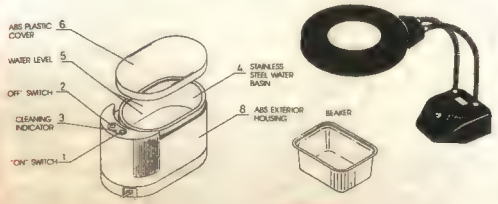
30610 Double Ended Set contains PH 1 Philips and 4.5mm Flat, PH 2 Philips and 5.5mm Flat, PH 2 Philips and 6.0mm Flat **$7.75**
30613 TORX Bit T 10 **$4.75**
30614 TORX Bit T 15 **$4.75**
30615 TORX Bit T 20 **$4.75**

WITTE TRIAX Insulated Screwdriver Set

High Voltage insulated (1000V) right down to tip. VDE approved for safety. Contains
Flat 0.4x2.5x75mm, 0.8x4.0 x100mm, 1.0x5.5x125mm, 1.2x6.5 x150mm
Philips PH 1x80mm, PH 2x 100mm
Mains Test Screwdriver **$49.50**

WITTE MICRON Chrome-Vanadium Screwdriver Set

Precision technicians set. Contains
Flat 0.4x2.5x75mm, 0.5x3.0 x75mm, 0.5x3.0x150mm, 0.6x3.5 x100mm, 0.6x3.5x150mm
Philips PH 0x60mm, PH 1x 80mm **$32.95**



ULTRASONIC CLEANER

The latest high-tech way to clean PCB's, switches, watches, drafting pens - even your dentures! Let the millions of tiny cavitation bubbles clean the surface 40000 times per second. 165x90x50mm container holds half a litre and is made of 304 stainless steel. Some people are charging $200. Our's are only **$160.**

Maggylamp

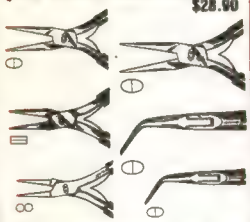
The remarkable Maggylamp magnifies any object under a clear cool light leaving both hands free . Essential aid to efficiency..

- 127mm bi-convex lens, 4.00dioptres, focal length 254mm.
- Flexible arms for easy positioning.
- Handsome sturdy construction.
- Essentially a microscope with lighting. Value at **$250**

C.K. Precision Tools

Made in West Germany specifically for the electronics industry with hand mirror polish. Box joints with double leaf springs. Induction hardened cutting edges. Ceka have built their reputation since 1790! *If you want the best... there's nothing finer.*

3754 Economy wire stripping pliers for reptitive work. Adjust to strip insulation only. Brass screw and locknut, coil spring. Insulated, slip guard handles. Polished head **$28.90**



3767 120mm Snipenose, bent pliers **$38.50**
3769 150mm Snipenose bent pliers **$33.10**
3783 145mm Needlenose pliers **$40.50**
3770 120mm Flatnose pliers **$37.00**
3771 120mm Roundnose pliers **$29.50**
3772 120mm Snipenose pliers **$39.95**
3773 115mm best seller standard angled side cutters **$42.50**
3775 135mm heavy duty angled side cutters **$44.60**
3776 130mm standard top cutter **$44.60**
3776F 115mm standard top cutter **$35.75**
3777 150mm Snipenose pliers **$39.50**
3780F110mm Mini small dimensioned, angled side cutters **$40.20**
3786F 120mm mini-oblique cutters **$45.85**
3798 120mm standard oblique cutters, short head **$50.60**
3799 29° angled head flush cutters 110mm ideal for tight spaces **$46.25**
3841 Short side cutters for hobbyists **$15.40**

C. K. 124P Needle File Set

Contains 6 files - square flat, pointed flat, square, round, half round, triangle. Second cur, chrome vanadium steel. Highest quality **$33.00**

C. K. 2302 Tweezers

Hand finished, balanced and sensitive with black PVC coating to tips **$7.35**

ARISTA ES-1 Electricians Neon Test Screwdriver

AC/DC tester 110V to 380Vmax. Checks live power points **$2.45**

ARISTA HT-28 Stubby Ratchet Screwdriver Set

3 position ratchet grip handle. Very compact. With 6 bits
Flat 0.6x4.5mm, 1.0x6.0mm
Philips PH 1, PH 2
Pozidriv PD 1, PD 2
Also accepts Witte tips **$10.95**

ARISTA HT-7 6 Piece Screwdriver Set

Contains Flat 1.4mm, 2.0mm, 2.4mm, 2.9mm.
Philips PH 0, PH 1 **$5.95**

HT-8 4 Piece Philips Screwdriver Set

Contains PH 00, PH 0, PH 1, PH 2 **$5.95**

HT-17 Watch makers Driver Set

Contains 16 separate tools for the handyman
Philips PH 1-1, PH 1-2, PH 0, PH 0-2
Hex Key 1.5mm, 2mm, 2.5mm
Nutdrivers 3mm, 4mm, 5mm
Flat 1mm, 1.4mm, 2mm, 2.4mm, 3mm, 3.8mm **$19.95**

ARISTA HT-11 Precision Tool Set

20 piece set with flat, Philips, nut and hex drivers, wrench and awl in pocket case. Contains –
Open Wrenches 4mm, 4.5mm, 5mm, 5.5mm, 6mm
Philips PH 0, PH 1.2
Nut Drivers 3mm, 3.5mm, 4mm, 4.5mm, 5mm
Four Hex Keys 1.5mm, 2mm, 2.5mm, 3.5mm
Flat 1.5mm, 2.5mm, 3.5mm
Awl, Locking Handle **$10.95**

ARISTA HT-6 Allen Key Set

1.5mm, 2mm, 2.5mm, 3mm, 4mm, 5mm, 5.5mm and 6mm Allen Keys on key ring **$4.95**

ARISTA Hobbyist Tools

HT-12 Miniature Diagonal Cutters **$10.95**
HT-13 Miniature End Cutters **$5.95**
HT-14 Miniature Diagonal Cutters **$9.95**
HT-15 Miniature Long Nose Pliers **$9.95**
HT-16 Miniature Cutters **$5.95**
HT-27 Magnetic Finger & Tweezer Set **$11.95**
CS-200 Single Operation Cable Stripper/Cutter **$13.95**
HT-25 Scribing tool with tungsten tip **$2.95**

Addison Drill Set

Rolling forged high speed steel to BS328-1959. 11 piece covers 1mm to 6mm. In sturdy steel stand-up case. **$14.50**

Boker Twist-N-Pick Drill Set

Contains 13 drills 1.5 to 6.5mm in 0.5mm steps plus 3.3 and 4.2mm. Convenient drum selector case. **$24.80**

Coax Stripper

Suits RG58 and RG59 **$41.95**

Coax Crimper

Suits RG58 and RG59 **$88.95**

D-Sub Crimper

Assemble contacts quickly **$88.95**

Nibbling Tool

Cuts up to 18gauge steel and other hardened metals. Ideal for copper, plastic, aluminium etc. Simply drill 3/8" hole Ideal for square panel cut outs **$19.95**

Hole Punch Set

10 piece screw type. Holes from 16mm to 30mm diameter. Includes tapered reamer and rigid plastic carry case. **$69.95**

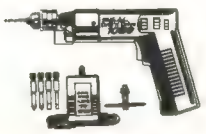
OKI Wire Wrap Tool

Finest quality **$19.50**
We also stock wrap wire

ARLEC SUPER TOOL

Operates from safe 12V via AC adaptor. It can Drill, Engrave, Erase, Grind, Mill, Polish, Sand Etc. *Supplied with* AC Adaptor, Spherical milling cutter, Wire brush, Grinding wheel, 4 Drill bits - 0.6, 0.8, 1.0, 1.2mm, 5 Chuck collets, 6 Eraser sticks
All for a low **$69.50**

Pack of 4 high speed drill bits
0.6, 0.8, 1.0 and 1.2mm **$6.50**
Milling cutters Set of 3 **$7.95**
Wire brushes Set of 3 **$14.40**
Grinding bits Set of 3 **$10.95**
Cutting discs Set of 6 **$10.95**
Eraser sticks Set of 10 **$3.50**



NOW FITTED WITH PROPER CHUCK... DRILL 'N DRIVE

Rechargeable two speed drill and screwdriver. Two Speeds Drill - 325 rpm, Screw-driver - 150 rpm. Forward and reverse operation. Pilot light for dark areas. Drills timber, metal, hardened plastic *Supplied with* Rechargeable Batteries, AC Adaptor
3 Drill Bits 2.0, 3.0, 4.0mm
2 Slotted Screwdriver Bits
2 Philips Screwdriver Bits
Incredible Value at only **$69.95**

Here's a few hot tips...

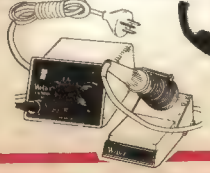
Weller Soldering Stations WTCPS

Transformer powered low voltage soldering station. Features Weller closed-loop method of controlling maximum tip temperature to protect temperature sensitive components.

- Grounded tip protects voltage and current sensitive components.
- 48W stainless steel heater construction
- Non-burning silicon rubber cord
- 15 tip sizes - 0.8mm to 6.00mm
- 11secs to recover for 37°C drop
- Choice of tip temperatures 315°C/600°F, 370°C/770°F, 430°C/800°F **$137.00**

EC1001D

- Electronic Temperature control to within ±6°C over the range 177°C to 454°C
- Three digit LED readout with ±1°C resolution
- Temperature control maintained for ±10% supply variation
- Rapid response platinum temperature sensor with full proportional control
- Thyristor power control with zero-voltage switching
- Grounded tip
- 42W/24Vac transformer operation
- 10 second recovery
- 14 tip styles - 0.8 to 5.0mm diameter **$195.00**



Weller SP140D 40Watt Industrial Soldering Iron

Ceramic filled element. Fast Heat-Up. Pre-tinned longlife plated tip and stainless steel construction. Light weight. Wide range of tips **$69.95**

ARISTA HT-5 20W 240V Soldering Iron

20W mains operated,370°C fixed temperature, iron clad chrome plated tip, 1mm, 1.5mm and 3mm tips available **$29.95**

ARISTA HT-35 16-25W Variable 240V Soldering Iron

Mains operated,variable temperature with LED indicator, iron clad chrome plated tip, 1mm, 1.5mm and 3mm tips available **$44.95**

PORTASOL PROFESSIONAL SOLDERING KIT

See E.A. April 88. No cords or batteries yet it gives the equivalent of a 10 to 60W iron. Up to 90 minutes continuous use from a single fill. Tip temperatures as high as 400°C can be set. The kit includes one soldering tip, a hot knife, blow torch and hot blow. Cap contains a flint lighter. Comes in a handy case (with stand for the iron) almost fits in your pocket. **$69.95**

PORTASOL STANDARD SOLDERING IRON

We've sold hundreds of 'em to servicemen and technicians. Complete and ready to use with just the iron and bit **$39.95**
Spare tips are each **$12.95**
Portasol gas specifically designed for PORTASOL 150g **$ 5.95**

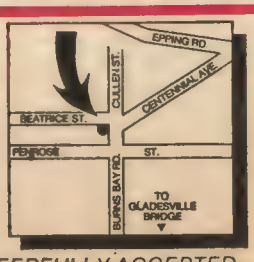
DIC-5000 Desoldering Tool

The SC-5000 gun incorporates a motorised diaphragm pump. No tubes or separate compressors. A built-in thermo- sensor circuit controls the 60W ceramic heater to ensure rapid warm-up. Exact temperature control prevents damage to sensitive circuitry. The gun can also be used as a hot blow tool. **$399.00** ex tax
$478.00 inc tax. Stand **$42.50**

GEOFF WOOD ELECTRONICS PTY LTD

229 Burns Bay Road, (Corner Beatrice St.) INC IN NSW
Lane Cove West, N.S.W. P.O. Box 671, Lane Cove N.S.W. 2066
Telephone: *(02) 428 4111* **Fax: (02) 428 5198.**
8.30am to 5.00pm Monday to Friday, 8.30am to 12 noon Saturday.
Mail Orders add *$5.00* to cover postal charges.
Next day delivery in Sydney add $5.00.

All prices INCLUDE sales tax.
Tax exemption certificates accepted if line value exceeds $10.00.
BANKCARD, MASTERCARD, VISA, CHEQUES OR CASH CHEERFULLY ACCEPTED



SUPPORT WORLD WILDLIFE FUND AUSTRALIA

... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ... WOOD FOR CHIPS ...

A practical approach to amplifier output stage design

There are many requirements for a successful amplifier design. One of the least understood is how to design the output and driver stages to remain within their safe operating areas. Faulty design here can be more than just expensive; the smoking remains are down right embarrassing.

By DAVID EATHER

Many cope with this task by copying from other designs. This is a limiting approach and almost invariably leads to designs with a certain sameness about them. Also, bad design is perpetuated. There is a better way.

This article shows a practical approach to amplifier output stage design and covers the calculation of power supply voltages, output load lines, derating transistor SOAR curves and heatsink selection.

You get nothing for nothing so before you start there is a fair swag of calculations to be done. You also need access to a power transistor data book. The payoff is reliable amplifiers with output power levels customised for your needs.

There are no definitive answers as to exactly how many or what type of transistors you have to use in your design; a lot depends on taste. At the same time, there are certain design rules that should not be transgressed. My method is a simplified approach - the overall aim has been to achieve a reliable design without too much pain. What has been shaved off one area is generally compensated for elsewhere.

For illustration, I will be designing the output and driver stage of a general purpose amplifier capable of 25 watts into 8Ω. The circuit is a simple 10-transistor design as shown in Fig.1.

After a general discussion on each step, I will provide some specific results, so you can check your understanding of the principles being discussed.

Assuming you already know how much power output you want, the first step begins with calculations to find the peak voltage and peak current delivered to the load. Use the following formulas.

V_{max} load = $\sqrt{(2 \times P \times Z)}$

I_{max} load = $\sqrt{(2 \times P/Z)}$

For my amplifier this works out as:

V_{max} load = $\sqrt{(2 \times P \times Z)}$
= $\sqrt{(2 \times 25 \times 8)}$
= 20 volts

I_{max} load = $\sqrt{(2 \times P/Z)}$
= $\sqrt{(2 \times 25/8)}$
= 2.5 amps

Emitter resistors

At this point, I will give a quick mention of the emitter resistors, R1 and R3, on Fig.1. These resistors help provide thermal stability of the output stage bias current and in designs with output transistors in parallel they help to ensure equal current sharing. The higher the resistance the better the thermal stability and current sharing but the more power they waste. The final value is a compromise.

As a guide, you would normally try for about 0.6 volts across the emitter resistors at I_{max} load.

For this design, 0.22Ω should prove adequate. The resistance is a little low but I would not expect any problems for the following two reasons: (1) there is only one output transistor for each rail so there is no current sharing; and (2) I don't intend to set a high quiescent current.

The next step is to work out the required supply voltage ($\pm V_{cc}$). You must consider the requirements of V_{max} load, the voltage drops caused by the driver and biasing circuitry and the voltage drop caused by the emitter resistors in the output transistors, and lastly the ripple voltage (hum and audio signal) on the supply rails ($\pm V_{cc}$).

At this stage, refer to back to Fig.1.

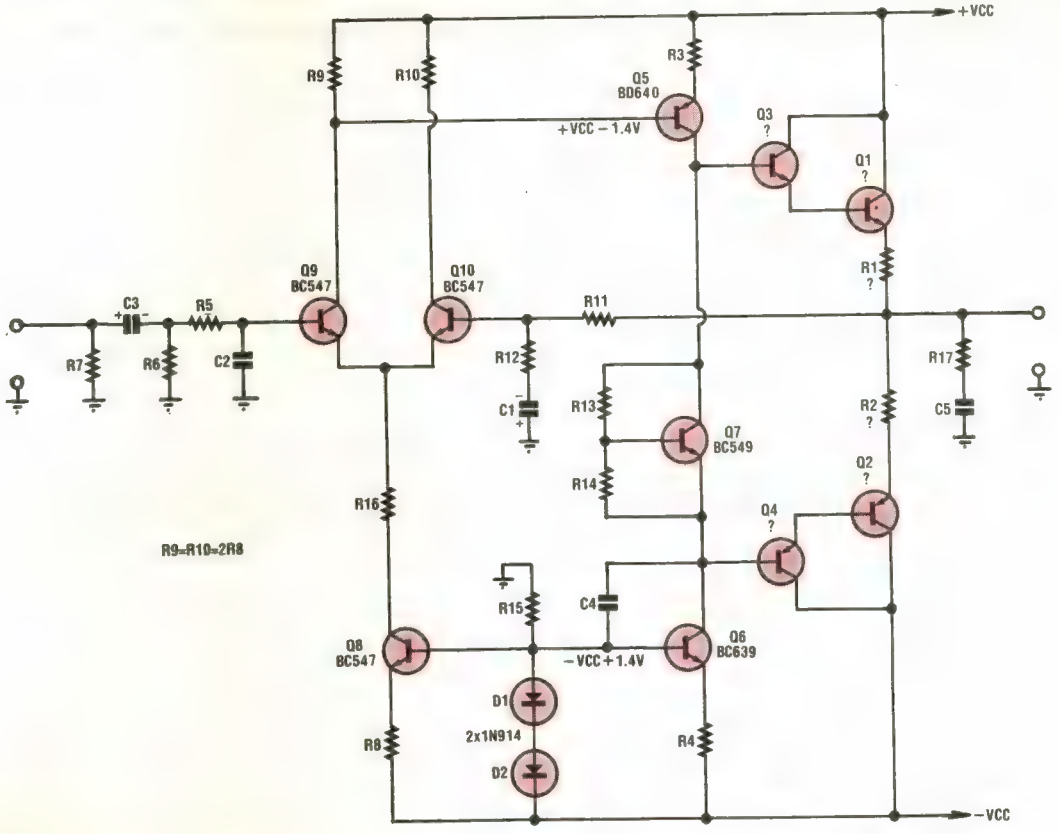


Fig.1: the circuit for a general purpose 10-transistor audio amplifier capable of delivering about 25W into 8Ω. Note that the design uses split supply rails and complementary output stages.

Notice that the bias voltages applied to the bases of Q5 and Q6 are equal. Notice also that the outputs, drivers and pre-drivers are mirror images of each other (R5, Q5, Q2 and Q1 vs R6, Q6, Q4 and Q3). This is a common situation and allows calculation for $\pm V_{cc}$ by considering just the positive side. In cases where the quiescent biasing varies for the positive and negative sides, the $\pm V_{cc}$ rails are worked out separately. Depending on the design, use the larger value for both supply rails.

In this example (see Fig.1 again), there is 1.4 volts across the base-emitter junction of Q5 and R3. We will assume that at full power, the same voltage of 1.4 volts appears between the collector of Q5 and $+V_{cc}$, 0.55 volt peak (I_{max} load x R1) across R1, and 1.6 volts across the base-emitter junctions of Q1 and Q3. This gives a total overhead of 3.55 volts.

Power supply ripple

Next, you have to make an estimate for the ripple on the power supply. For this I like to use what I call Eather's rule of thumb. Stated as a formula it looks like this:

$V_{ripple} = 6300 \times I_{max}\ load/C$

where V_{ripple} is the peak to peak voltage ripple on the power supply and C is the filter capacitor size in microfarads. The capacitors should be a minimum of 100-200μF per watt of output power for a class B amplifier with a full wave rectifier. (Actually, Eather's rule of thumb is not just a whim of mine but is a condensation of the maths for capacitor-input power supplies).

For this example, I have elected to use two 2500μF capacitors for each power supply rail:

$V_{ripple} = 6300 \times I_{max}\ load/C$

$= 6300 \times 2.5/2500$

$= 3.15$ volts

The value for $\pm V_{cc}$ is:

$\pm V_{cc} = V_{max}\ load + V_{ripple} + circuit\ overhead$

For my design this becomes:

$\pm V_{cc} = V_{max}\ load + V_{ripple} + circuit\ overhead$

$= 20 + 3.15 + 3.55 = 26.7$ volts

This can be safely rounded off to ±27 volts.

Transistor load lines

OK so far? The next step is to figure out the transistor load lines. We are not going to bother with the load lines for resistive loads. These are straight lines and not really the problem for amplifiers. We are concerned with reactive load lines. These show the instantaneous voltage and current flowing through the transistors when driving a complex load impedance such as a speaker.

To do this you need the output power, I_{max} load and $\pm V_{cc}$. You also need the value of the emitter resistors in the output stage (R1, R2 in my case), the power output of the amplifier and the load impedance, Zl.

Before leaping into the computations, we need to make an estimate of the maximum phase shift caused by the inductive portion of the speaker load. 45° seems to be the accepted standard in many electronics magazines and is the value we shall use

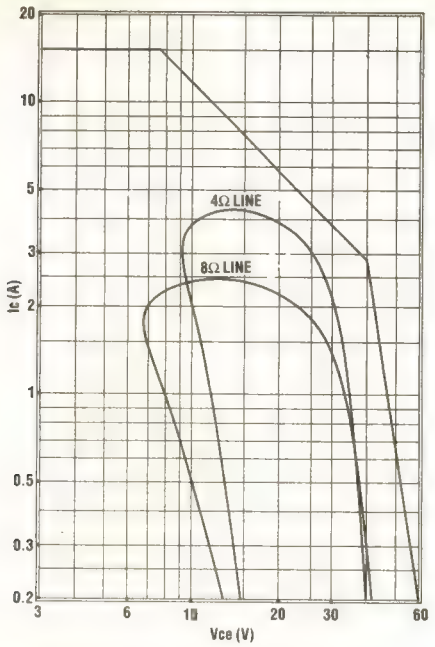


Fig.2: the 4Ω & 8Ω load lines for the output transistors of the amplifier. These curves were plotted using the data shown in Tables 1 & 2 respectively. Note that the load lines should be fully enclosed by the DC SOAR curve of the selected transistor as shown here.

here. However, if you intend to use your amplifier with highly reactive loads such as electrostatic speakers or line transformers, 60° would be a better choice.

Drawing up a table

Now we draw up a table with five columns and 13 rows. The columns are labelled: (ωt - θ), ωt, I_c, V_{ce} and P_{pk}(W). Theta (θ) is the electrical phase shift caused by the speaker. The term "ωt" is the instantaneous phase of the signal frequency and is expressed in degrees. I_c is the instantaneous current through the collector of the output transistor. V_{ce} is the instantaneous voltage across the output transistor. P_{pk}(W) is the instantaneous power dissipated by the output transistor.

The (ωt - θ) column starts at 0 and steps up to 180° in 15° increments. Down the ωt column write the corresponding value of ωt. This is the same as adding the selected value of θ (45° in our case) to the adjacent value of (ωt - θ). This leaves the ωt column with values starting at 45° and ending at 225°.

Start the calculations with I_c, using the formula:

$I_c = I_{max\ load} \times \sin(\omega t - \theta)$

Write down each result in turn for the value of ωt. Next is V_{ce} using the more complex formula:

$V_{ce} = V_{cc} - I_{max\ load} \times Z_l \times \sin(\omega t) - I_c \times R_E$

The column for P_{pk}(W) is calculated by multiplying the collector emitter voltage Vce by the collector current I_c:

$P_{pk}(W) = V_{ce} \times I_c$

Table 1 shows the results for the amplifier under discussion.

Load variations

Now take a deep breath. A general purpose amplifier could drive all sorts of speakers, some with only a very nominal 8Ω impedance. For amplifiers in this situation, it is normal to design the amplifier so that it can safely drive into half the nominal load impedance. This may not be necessary if the amplifier is to drive a known speaker impedance or if using electronic limiting. If electronic limiting is not done carefully though, the amplifier may produce objectionable distortion if pushed hard into a non-resistive load.

The rule of thumb for estimating power output into half the nominal load impedance is that the amplifier will produce about 50% more power. This won't apply if the amplifier has a well regulated power supply and large filter capacitors, in which case the power output will be closer to double. Conversely, if the power supply has poor regulation and small filter capacitors, the amplifier may only deliver a few percent more power into half its nominal load impedance.

First, assume your amplifier will deliver 50% more power. Then you have to check that your amplifier will really deliver this power into the new load. Why? Because if it can, it will have to dissipate a lot more power and we need to know that the transistors can stand this extra stress.

Work out the required value for V_{cc} for the increased power output. This means going through the same procedure you did before, finding the required voltage across the load, the amplifier overhead and the power supply ripple using the new load impedance.

A required value for V_{cc} much larger than that available from your power supply means that the amplifier won't be able to deliver the extra 50% power, except maybe for short peaks. If the required value for V_{cc} is less than the actual supply, the amplifier will deliver a bit more than an extra 50%.

Most times, allowing 50% gives a close estimate of what will actually happen. If, in your case, the value you came up with for V_{cc} was very different, adjust your estimate of output power and go through the checking procedure again.

For my amplifier, half the load impedance equals 4Ω and I expect the amplifier to deliver about 37 watts. The calculations for $V_{max\ load}$ and $I_{max\ load}$ give 17.3 volts and 4.33 amps respectively.

The amplifier overhead goes up by 0.4 volts to 3.95 volts due to the higher current through the emitter resistors. The ripple on the supply also increases to 5.45 volts. So the V_{cc} needed is still about 27 volts.

The next step is to calculate another load line for the new load impedance. Use the new values for Zl and $I_{max\ load}$.

My results for output into a 4Ω load are tabulated in Table 2. We can now draw some conclusions about the possible output transistors. The output devices must have an I_c rated higher than $I_{max\ load}$. The V_{ce} must be twice V_{cc} and the power rating should be at least 50% greater than the largest value for P_{pk}(W) for most designs.

In suggesting 50% more for the power rating of the output transistors, I am assuming power dissipation is the limiting factor and not secondary breakdown. It is just a ballpark figure and may need adjustment.

Output transistors

For your design, you should be able to make an educated guess about what output transistors or combination of transistors you will need to use.

For my job, I will need the output transistors to have an I_c of more than 5 amps, a V_{ce} of 60 volts or more, and a power rating of around 100 watts.

I can now select some possible devices.

For my design, transistor pairs such as the MJE3055/MJE2955, TIP3055/TIP2955, 2N3055/MJ2955 or MJ-15003/MJ15004 could all be suitable.

I won't use the TIP and MJE pairs because the packages are not pin compatible even though they are of-

Table 1

ωt-θ	ωt	Vce	Ic	Ppk(W)
0	45	12.858	0.000	0.000
15	60	9.537	0.647	6.171
30	75	7.406	1.250	9.258
45	90	6.611	1.768	11.687
60	105	7.205	2.165	15.600
75	120	9.148	2.415	22.091
90	135	12.308	2.500	30.770
105	150	16.469	2.415	39.769
120	165	21.347	2.165	46.218
135	180	26.611	1.768	47.042
150	195	31.901	1.250	39.877
165	210	36.858	0.647	23.848
180	225	41.142	0.000	0.000

Table 2

ωt-θ	ωt	Vce	Ic	Ppk(W)
0	45	14.753	0.000	0.000
15	60	11.754	1.121	13.172
30	75	9.794	2.165	21.204
45	90	9.006	3.062	27.576
60	105	9.445	3.750	35.418
75	120	11.080	4.182	46.343
90	135	13.800	4.330	59.755
105	150	17.420	4.182	72.858
120	165	21.692	3.750	81.344
135	180	26.326	3.062	80.605
150	195	31.007	2.165	67.129
165	210	35.414	1.121 3	9.687
180	225	39.247	0.000	0.000

ten sold as being interchangeable. The mounting tab is on opposite sides when placed into a PC board. This has the potential for mistakes during construction or repairs. Also, the power rating for these transistors is a bit low (only 90 watts). They could work but I will look around for something else.

The 2N3055/MJ2955 pairs have a higher power rating for only a few cents more. This higher power rating could lead to cost and size savings by enabling the use of a smaller heatsink.

The MJ-15003/15004 pairs are nice but relatively expensive. Compared to the 2N3055/MJ2955 pair, they do offer a better current gain-bandwidth product (ft) and would give slightly lower distortion. Also the much higher power rating means I could possibly get away with quite a small heatsink.

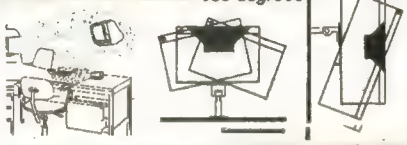
Overall, the 2N3055/MJ2955 pairs should perform satisfactorily in my circuit so they are my first choice.

At this stage, the choice of output transistors is no more than an educated guess. It is possible that the transistors may not be suitable. The graph of the load lines, transistor SOAR curves and the heatsink calculations will confirm the final choice.

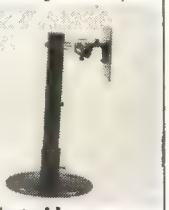
This is the time to check your transistor data book closely. Enlarge or redraw the safe operating area (SOAR) graphs for the transistors until they are a convenient size. Then plot the

HEAVY DUTY TV/SPEAKER WALL-CEILING BRACKETS

The MB3 and MB5 are heavy duty two platform mounting brackets designed for securing small TV's and speakers to walls, ceilings, desks or bench tops. When mounted both units can be rotated 360 degrees



as well as being swivelled up or down to any viewing or listening angle. The metal platforms have predrilled holes for mounting and are easily adjusted with a large allen key supplied with the unit.



Imported and distributed by:

ARISTA ELECTRONICS

Available through the following retailers:

David J Reid Electronics. 127 York Street. Sydney. 2000. NSW. (02) 267-1385.

All Electronic Components. 118 Lonsdale St. Melbourne. 3000. Vic. (03) 662 3506.

SOUND AUSTRALIA

Your P.A. Accessory Specialist

Electronic Component Specials

555 Timer	$0.10ea
4001	$0.15ea
4007	$0.15ea
4011	$0.15ea
4013	$0.15ea
-15volt regulator	$0.15ea
LED's 5mm	
Red, Green, Orange, Yellow All the same price	$0.10ea
V28 7MHz	$7.95ea

HEAVY DUTY CARPETED ROAD CASES

4 Unit $100.00 6 Unit $115.00
8 Unit $135.00 10 Unit $155.00
12 Unit $175.00

Rack cases can be made to order in any size and any carpet colour.

HANDLES

6" Strap	$1.95	8" Strap	$ 2.45
10" Strap	$4.95	8" Nylon	$ 2.95
Briefcase Style			$ 2.95
Chest Handle Metal			$ 5.95
Recessed Spring Handle			$12.95

Please Call for a Catalogue

SOUND AUSTRALIA

28 Walker St. Dandenong, VIC, 3175

Telephone: (03) 791 1622

Table 3

ωt-θ	ωt	Vce	Ic	Ppk(W)
0	45	12.858	0.000	0.000
15	60	9.537	0.032	0.309
30	75	7.406	0.063	0.463
45	90	6.611	0.088	0.584
60	105	7.205	0.108	0.780
75	120	9.148	0.121	1.105
90	135	12.308	0.125	1.538
105	150	16.469	0.121	1.988
120	165	21.347	0.108	2.311
135	180	26.611	0.088	2.352
150	195	31.901	0.062	1.994
165	210	36.858	0.032	1.192
180	225	41.142	0.000	0.000

Table 4

ωt-θ	ωt	Vce	Ic	Ppk(W)
0	45	14.781	0.000	0.000
15	60	11.789	0.056	0.659
30	75	9.834	0.108	1.062
45	90	9.048	0.153	1.382
60	105	9.486	0.187	1.774
75	120	11.117	0.209	2.319
90	135	13.831	0.216	2.987
105	150	17.442	0.209	3.639
120	165	21.705	0.187	4.060
135	180	26.328	0.153	4.021
150	195	30.997	0.108	3.348
165	210	35.394	0.056	1.979
180	225	39.219	0.000	0.000

load lines for the amplifier using the points you calculated above.

Fig.2 is my plot for the 4Ω and 8Ω loads using the data in Tables 1 & 2. You may be used to seeing these load lines in text books on graphs with a linear scale and think mine look a bit strange. Don't worry, they are the same type of graph only the scales are logarithmic.

Notice how the 2N3055 SOAR curve fully encloses the load lines. If this were not the case, then the amplifier may die on the first occasion it is required to give a big burst of power.

Make sure the load lines are fully enclosed by the DC SOAR curve of your transistor. The fully enclosed load lines show that the selected power transistor can work in the design.

Driver transistors

Now we come to the driver transistors.

The first step is to calculate the load impedance presented to the driver transistors. In my case, it is simply the speaker impedance multiplied by the minimum beta of the output transistor over the range of currents of interest (0 to I_{max} load).

For the 2N3055, the minimum beta is 20.

Calculate I_{max} for the driver by dividing I_{max} load by the beta of the output transistor. If your circuit calls for it, make sure you add in any other currents the driver transistor must supply.

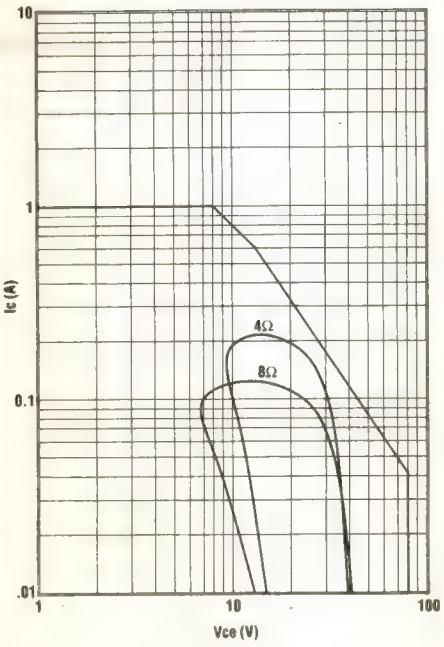


Fig.3: these curves show the load lines for the driver transistors & were plotted using the data shown in Tables 3 & 4. As with the output devices, the load lines must be fully enclosed by the DC SOAR curve of the transistor.

Now calculate points for the load lines for the driver transistors in the same way as for the output transistors. Remember to do this for half the nominal load impedance if applicable.

My results are tabulated in Tables 3 and 4 while Fig.3 shows the plotted load lines. Note that, as with the output devices, these load lines must be fully enclosed by the DC SOAR curve of the selected transistor.

Go through the same selection procedure as you did for the output transistors.

For my case, a look down the tables on this page shows a peak power dissipation of 4.06 watts and a maximum current of 216mA. Notice that even at these modest power levels, small signal transistors like the BC546/7/8 aren't able to cope. Be wary of designs that suggest they will. I will try a BD139/BD140 pair for the driver transistors.

Next month, we will see if a pair of BD139/BD140 transistors is up to the task of being driver transistors in the circuit of Fig.1. I think that they will but we'll find out for sure, next month. See you then. **SC**

We Want Your Business

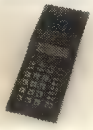
SHERIDAN ELECTRONICS

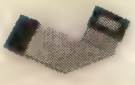
68705 (Motorola) 6805 Processor with Eprom
$11.50each

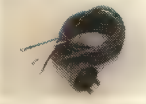
IC SOCKET PACK
30 ASSORTED SIZES
$2.95
PER PACK

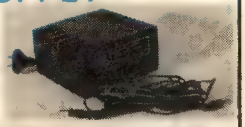
SUPER CAPS
.047 5.5v KEEP THE VOLTAGE IN YOUR MEMORY
80cents each

OTHERS SELL THESE FOR $3.95

TYTEL KEYPAD
COMPLETE WITH LCD DISPLAY, AND SPEAKER

$4.95ea

5" 24 WAY IDC HEADER CABLES
$2.00ea


3 CORE MAINS LEAD AND PLUG
GREAT FOR ANY MAINS PROJECT
$2.50ea


DISK DRIVE POWER SUPPLY
17 volt 3.4A,
8.5 volt 6.8A

BRAND NEW $19.95

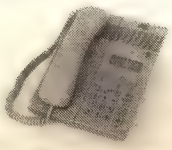
TRANSMITTING VHF/UHF VALVE
2C39BA AIR COLLED 250 WATTS 50 WATT RE CUT
$30.00 each

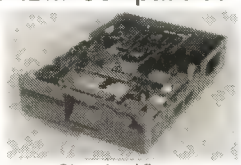
NORMAL PRICE $225.00

ELECTROLITIC CAPS
91000 uF 15v
$6.00ea
14000uF 25v
$4.00ea
by MALLORY

NEC 432156-10
62256 STATIC RAM
WE HAVE THE CHEAPEST PRICE IN TOWN
$8.50ea

240v MOTOR BY JAPAN SERVO CO.
80mm x 80mm x 75mm
1800 rpm 100mA with 3uF STARTER CAP THERMALLY PROTECTED
$19.95 each

SCOOP PURCHASE
TYTEL TELEPHONES
HANDSFREE DIALING, 12 MEMORY, TONE OR PULSE, LED DISPLAY plus many other features. **THESE PHONES ARE BRAND NEW**
$110.00 each

NORMAL RETAIL PRICE $425.00

360k D/S DISK DRIVE
SUITS XT or AT IBM Compatibles
$49.95 NEW

Just about as cheap as a Cleaning Kit

TRANSFORMER
12.5v plus 12.5v @ 1.5amp
8v @ 3amp
PRIMARY: 2x110v
$19.95ea

75ohm BNC CABLES
CRIMP PLUGS ON BOTH ENDS
3 Metre $3.95ea
6 Metre $5.50ea

SCORE MATIC CADDY
Replace your pen and score cards forever with this handy mini computer. You can keep tally of up to 4 players and can save your game for later recall. Many other features. Runs of two batteries which are supplied
$14.95

Great Gift
Advertised elsewhere for $39.95

SPECIALS LIST

MAGNETS 25mm x 10mm	$0.20ea
22 uF 100v PCB ELECTRO'S	$2.00/10
3v LITHIUM PCB BATTERY	$0.50ea
MINI MICRO SWITCH WITH LEVER	$0.50ea
MOC8042 OPTO COUPLER	$0.50ea
VARISTER 88JL	$3.45ea
.01 uF 50v MONO CAP	$2.00/50
5-6v ZENERS 400mw	$1.00/20
Z80 OTC	$1.00ea

SHERIDANS WILL BUY YOUR SURPLUS STOCK

SHERIDAN ELECTRONICS, 328 ELIZABETH ST,
(Cnr Kippax St. opp. Central Station & Dental Hospital)
SURRY HILLS, NSW, 2010 TELEPHONE: (02) 281 7727

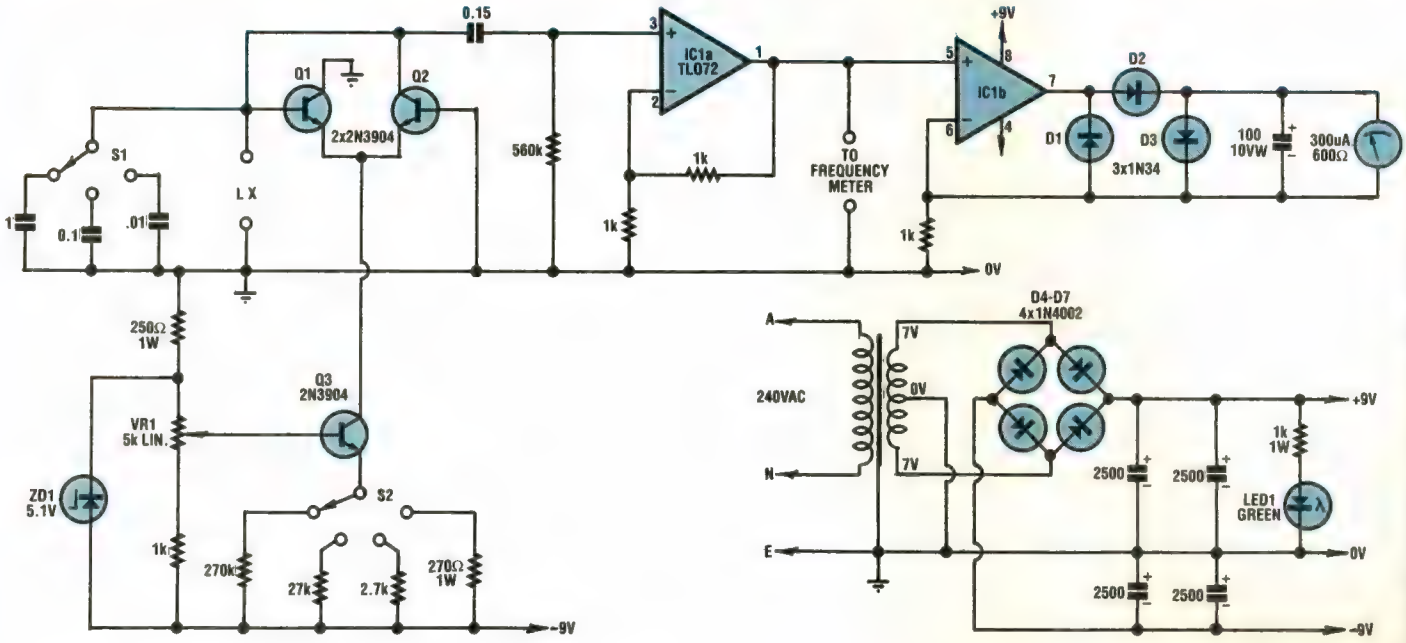
VISA

SHOP HOURS:

MON - FRI	9.00am - 5.30pm
SAT	9.30am - 12.00pm

CIRCUIT NOTEBOOK

Interesting circuit ideas which we have checked but not built and tested. Contributions from readers are welcome and will be paid for at standard rates.



Wide range inductance meter

This economical inductance meter is based on a wide-range oscillator and can measure inductances from 3 microhenries up to to 100 henries.

Transistors Q1 & Q2 form the wide-range oscillator which is capable of covering from 10Hz to 30MHz. These two transistors are emitter coupled, with the collector of Q2 fed back to the base of Q1. The unknown inductance, together with one of three capacitors selected by S1 (.01µF, 0.1µF & 1µF), forms a tuned load which sets the oscillator frequency.

A constant current source based on Q3 and ZD1 feeds the emitters of both Q1 and Q2. This current can be varied by means of VR1 and S2, and is used to set the emitter resistance of Q1 and Q2 and thus the gain of the oscillator circuit. In operation, the constant current source is adjusted so that the circuit just oscillates.

The oscillator output level is self-limiting and has an amplitude of about 0.6V p-p. It is coupled to the pin 3 input of non-inverting amplifier IC3a, which is half of a dual JFET op amp package. This device was chosen because its unity gain bandwidth is greater than 3MHz, because of its high slew rate, and because it costs less than $3.00. IC1a operates with a gain of two and drives a frequency meter. It also drives IC1b which, together with diodes D1-D3, operates as a precision rectifier and drives a 300µA meter.

The 300µA meter is used to indicate the onset of oscillation. Germanium diodes were selected for D1-D3 because their forward drop is less than 0.15V, which means that the meter will still operate at 3MHz when the gain of the amplifier is reduced to unity.

The inductance meter can be calibrated against inductances of known value. If you use a digital frequency meter, you can produce frequency to inductance conversion tables. Alternatively, if an analog frequency meter is used, its face can be calibrated to give a direct reading.

Power for the circuit is obtained from a mains transformer which drives a bridge rectifer to obtain ±9V supply rails. LED 1 provides power indication.

The test procedure is as follows:

(1). Connect the inductance to the test terminals and set all controls anti-clockwise so that the 1µF capacitor is in circuit, VR1 is set to give maximum base voltage, and the 270kΩ emitter resistor is selected. If the meter shows an indication, then rotate VR1 clockwise to reduce the meter reading to say 5µA and read the frequency meter.

(2). If the meter gives no indication, switch S2 to the next lowest value until the meter gives an indication, then rotate VR1 clockwise until the meter drops to 5µA and read the frequency meter.

(3). If, having selected all the resistors in the emitter, you obtain no reading on the meter, set S2 back to the 270kΩ position and select the next lowest capacitor using S1. Repeat the above procedure until you obtain a reading.

(4). Note that the same inductance can be measured using several capacitor settings. If the meter cannot be brought down to about 5µA with the 270kΩ emitter resistor in circuit, connect a 68kΩ resistor to the test terminals in parallel with the unknown inductor.

Victor Erdstein,
Highett, Vic. ($35)

Mid-frequency tone control

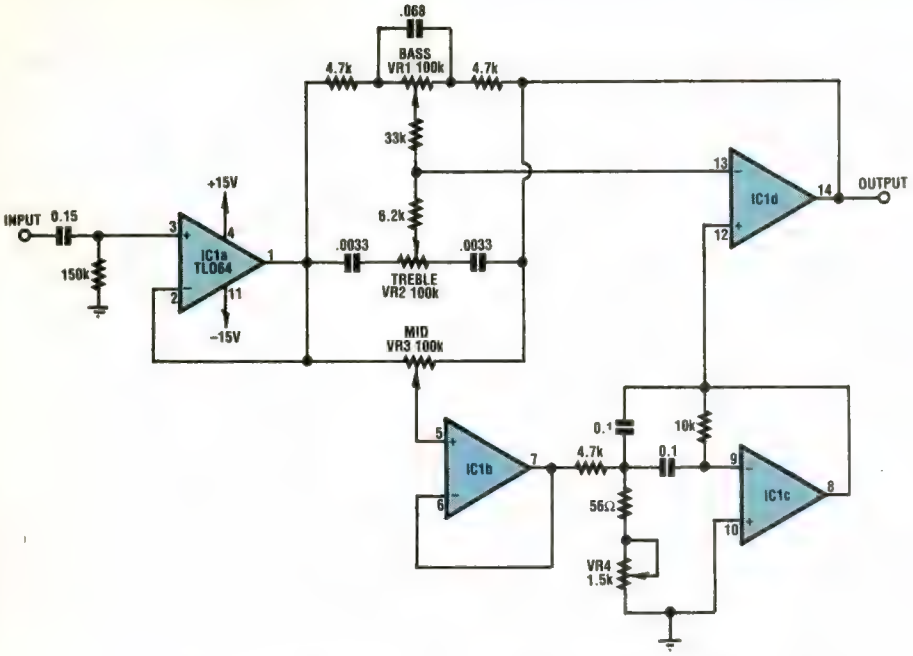
Adding a mid-frequency control to the standard Baxandall bass and treble controls is not an easy task. This circuit adds two op amps to provide the midrange control, leaving the bass and treble controls as normal.

IC1b acts as a voltage follower with its input coming from the 100kΩ midrange control which is connected across the existing feedback network for IC1d.

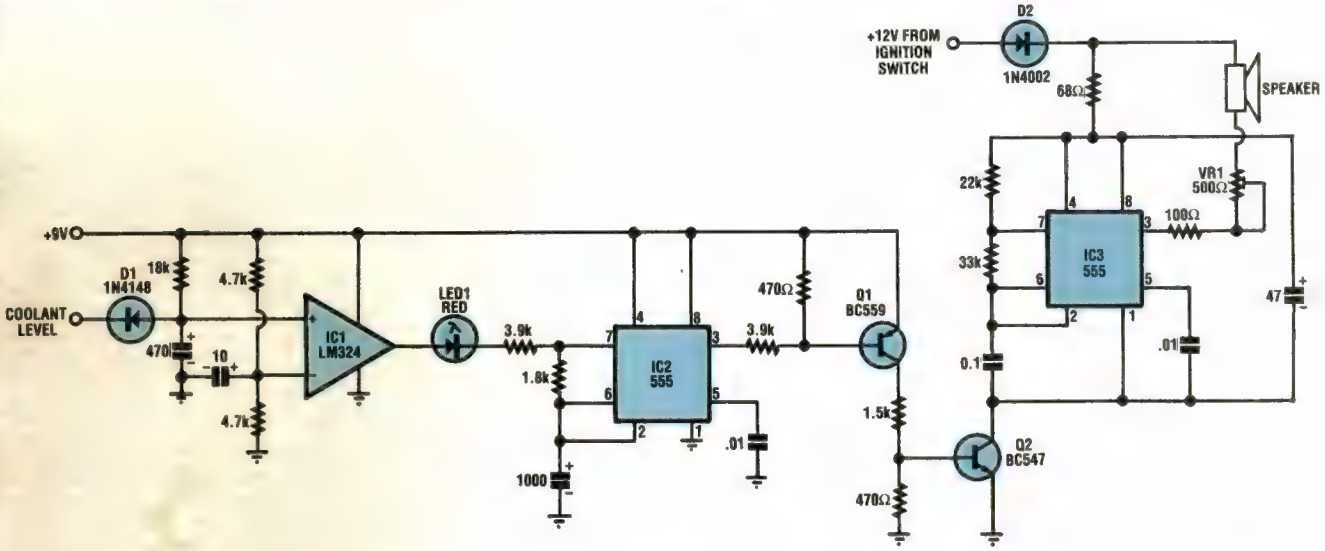
The output of IC1b then feeds IC1c which is connected as a bandpass filter, to feed and bias the non-inverting input of IC1d.

Overall midrange control is claimed to be ±10dB in the range 450Hz to 2kHz, with a -3dB bandwidth of 350Hz, depending on the setting of VR4.

While the circuit is shown using a TL064, it could be used with a TL084 or TL074, with the latter giving a lower noise figure.



From "Electronics World + Wireless World", October 1990.



Coolant level alarm for cars

Unless you own an air-cooled VW, this idea could save you a lot of money and your engine as well! The circuit monitors the coolant level in the radiator and when it gets below a certain level, an alarm sounds.

The sensor used is a Ford part, XF 10K889A, as some of the bigger Ford's have provision for this to be fitted to the radiator. The circuit works as follows: While there is sufficient coolant to cover the sensor, which is essentially an insulated stainless steel pin, the non-inverting pin of the LM324 op amp (IC1), wired as a comparator, is held at +0.7V by the input diode (D1), and the output of the op amp remains low.

Once the coolant level drops, the 470µF capacitor at the non-inverting input charges up via the 18kΩ resistor. Once the voltage across the capacitor reaches ½Vcc, the output of IC1 goes high.

Visual indication that something is wrong is provided by LED 1. This output is then fed to the input stage of a 555 oscillator (IC2) which has a frequency of 1Hz, as set by the 3.9kΩ and 1.8kΩ resistors and the 1000µF capacitor.

The output from pin 3 is fed to an inverter/driver stage consisting of Q1 and Q2. Q2 switches in another 555 oscillator (IC3) which provides an audible alarm to drive the loudspeaker. VR1 allows the alarm volume to be adjusted.

Glen Host,
Doubleview, WA. ($25)

A synthesised stereo AM tuner

If you have the right equipment, stereo AM radio can sound fantastic. This new stereo AM tuner will really deliver the goods. It's based on a stereo AM receiver chip and features pushbutton tuning and digital frequency readout.

By JOHN CLARKE & GREG SWAIN

In September 1989, we published a 2-Chip Portable AM Stereo Radio based on Motorola's new high-performance MC13024 IC. That design is very popular but, since publication, there has been a steady stream of requests for a mains powered version with digital readout.

This new tuner is our response to those many pleas. It's very easy to build and align, yet boasts many impressive features such as 6-station memory, synthesised tuning with microprocessor control, digital readout and, of course, AM stereo decoding. It delivers low-distortion wideband stereo sound which, as far as most people are concerned, is every bit as good as FM stereo sound.

One of our main concerns in producing a "high-tech" design such as this was that the unit had to be easy to build. This has been achieved by mounting most of the parts on two PC boards which are then soldered together to give a neat assembly. This assembly then fits into a slimline rack mounting case to give the tuner a modern appearance.

All the control switches, the indicator LEDs and the digital displays are mounted on the display board. The switches and indicator LEDs protrude through holes in the front panel while the four digital displays are located behind a red perspex window. You don't have to get involved in too much metal bashing though - at least one kit supplier (Dick Smith Electronics) will be supplying a kit with a fully pre-punched front panel that will feature screen-printed gold lettering.

A bevelled perspex window that slots into place in the front panel cutout will be included as part of the deal.

Front panel controls

Let's take a look at the front panel layout. At the extreme left is a pushbutton on/off switch, while immediately to its right are a 5-LED signal strength indicator, the frequency display window and a stereo indicator LED. Next in the lineup are pushbutton switches for station seek and memory enable, and then the six station memory buttons. Finally, at the extreme right, there are two pushbutton switches for down/up tuning.

Despite its "high-tech" design, the new tuner is easy to build. Most of the parts are mounted on two PC boards which are soldered together at right angles. This view shows the completed assembly, before installation in the case.

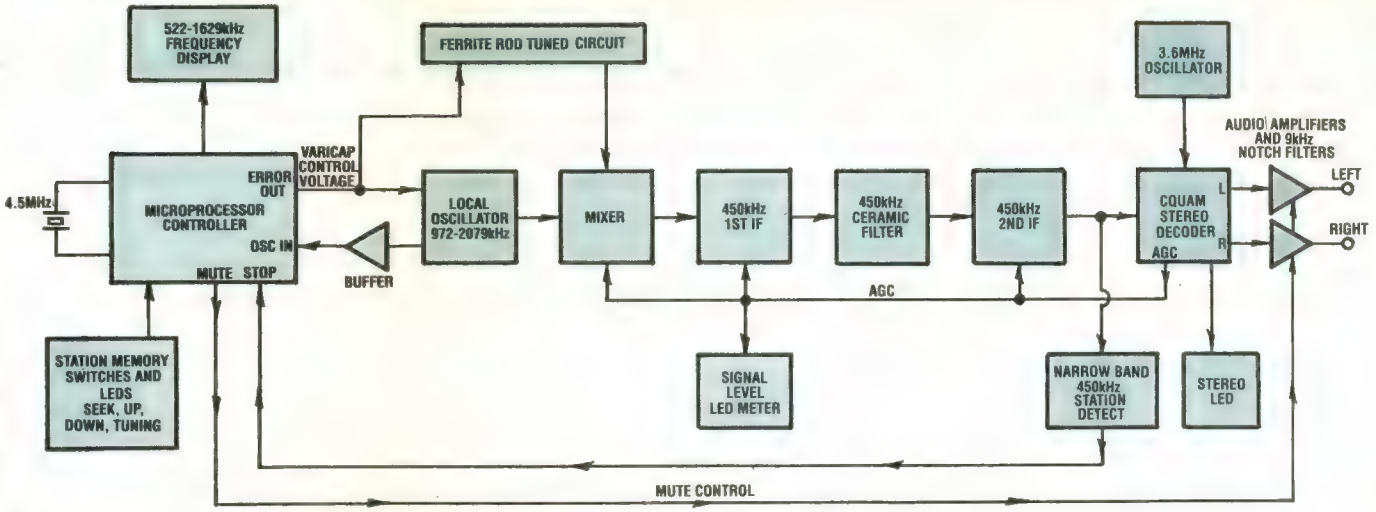


Fig.1: block diagram of the Stereo AM Tuner. It operates on the superheterodyne principle, which means that the local oscillator always runs 450kHz higher than the tuned RF (radio frequency) signal. The tuning is fully synthesised & is controlled by a microprocessor chip which also drives the LED displays. Most of the tuner functions shown are contained in a single IC - the MC13024.

These controls are all easy to use. For example, when the Seek control is pressed, the tuner automatically scans up the frequency band and locks onto the next available station. The Memory Enable control allows you to store pre-selected stations in any one of the six memories. You simply tune to the desired station, then press the Memory Enable and the desired Memory switch to store the station setting.

If the station switch is not pressed within five seconds, the Memory Enable LED extinguishes.

Of course, you can tune manually if you wish and that function is provided by the Down/Up pushbuttons. When these buttons are pressed, the tuner steps up or down in 9kHz steps. If either button is held down, the tuner scans at a fast rate until the button is released. The stereo indicator LED lights whenever a station is received in stereo.

Ferrite rod antenna

For ease of antenna adjustment, we opted for a ferrite rod assembly instead of a long wire loop antenna. This is installed on an adjustable mount on the rear panel and provides excellent signal pickup compared to a balanced loop configuration.

The antenna coil is a commercial unit by the way, so you don't have to go to the trouble of winding it. Nor do you need any special equipment to align this tuner - just a couple of plastic alignment tools and a multimeter. The alignment procedure is carried out using off-air stations and by measuring the AGC voltage.

Block diagram

Take a look now at Fig.1 which is the block diagram of our new tuner. It operates on the superheterodyne principle which means that the local oscillator frequency is always 450kHz above the tuned radio frequency (ie, the station frequency).

Both the RF and local oscillator stages are tuned using varicap diodes. These diodes are connected in parallel with inductors to form tuned circuits and vary their capacitance according to a control voltage.

The microprocessor controller plays a very important role in the operation of this circuit. In addition to driving the front panel display, it also provides synthesised tuning for the AM tuner front end plus audio output switching and the station seek function.

There are several inputs to the microprocessor which control its operation. These include an input from the local oscillator, a Stop input from the station detector, and various inputs from the front panel switches (Up/Down tuning, Memory switches, Memory Enable and Seek).

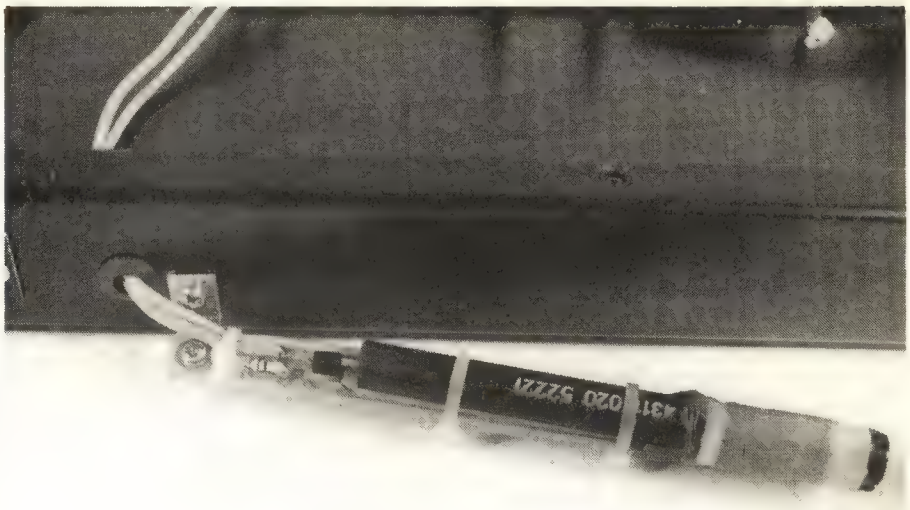
Basically, the microprocessor functions as a phase lock loop consisting of three sections: a reference frequency oscillator, a programmable divider and a phase comparator. In operation, the value of the programmable divider is set by inputs from the external switches. Depending on these inputs, it divides the external 4.5MHz crystal frequency to provide a reference frequency in the range 522-1629kHz. This reference frequency is always some multiple of 9kHz, which corresponds to the station spacing.

Inside the microprocessor there is also a counter which subtracts the 450kHz offset from the local oscillator. The resulting frequency is then compared with the reference frequency from the programmable divider. This produces an error output voltage which is then fed to the varicap diodes to lock the tuner to the desired station.

In addition to frequency synthesis, the microprocessor also has outputs which drive the 4-digit frequency display and the memory enable and memory selection LEDs. These displays are all multiplexed. There is also a Mute output and this is used to switch out the audio amplifiers during tuning to eliminate noise.

Tuner section

Although shown as separate blocks, most of the AM tuner section of the circuit is contained in a single IC - the Motorola MC13024. Those parts inside the chip include the local oscillator, the mixer, the two IF stages, AGC circuitry, a stereo pilot tone detector and a C-QUAM stereo decoder. To these, we have added the necessary tuned circuits for the RF and IF stages, plus signal strength indication, a station detect function and audio output stages.



The ferrite rod is installed on a small PC board along with its varicap tuning diode & a few other parts. This assembly in turn mounts on an adjustable bracket on the rear of the chassis, so that the ferrite rod can be oriented for best signal pickup.

Following the mixer, the signal is fed to the 1st IF stage and thence to a wideband 450kHz ceramic filter. This filter has a response which is only 6dB down at ±12kHz but is then sharply rolled off to be 35dB down at ±20kHz to reduce noise. The output from the filter is then fed to the 2nd IF stage and thence to the stereo decoder.

The output from the 2nd IF stage is also fed to a narrow band station detector block. This block consists of a narrow band ceramic filter, a gain stage and a comparator. Because the ceramic filter has a very narrow bandwidth (about 2.5kHz), the output of the comparator goes high only when the tuner is locked to the exact station frequency. This high is applied to the Stop input of the microprocessor and ensures that the tuner locks to the next available station when the Seek function is used.

Stereo decoding

An AM stereo transmission consists of an L+R (left plus right) mono signal plus a phase encoded L-R signal. To decode the L-R signal, the CQUAM decoder compares the phase changes in the 450kHz IF signal with a reference signal. This signal is derived from a 3.6MHz oscillator, which is divided by eight internally to give the required 450kHz reference.

In operation, the decoder compares the phase changes in the IF signal against the reference and derives an error voltage using a PLL circuit. This error is then used to adjust the 3.6MHz oscillator, to bring it into lock with the IF signal.

The phase fluctuations in the IF signal are interpreted by the IC as L-R stereo information. Once this signal is extracted, all that remains is to add and subtract it to the L+R mono signal to get the required left and right stereo outputs.

The MC13024 will not switch into stereo mode on just any signal, however. The signal has to be confirmed as a genuine CQUAM stereo signal by detecting a 25Hz pilot tone in the L-R signal. If this tone is not present, the decoder will remain in mono.

AGC voltage

In addition to stereo decoding, the CQUAM decoder also derives an AGC (automatic gain control) voltage from the recovered audio. This voltage is used to control the gain of the preceding mixer and IF stages, so that the audio output level remains constant regardless of signal strength.

The AGC voltage is also used to drive a signal level indicator. In this circuit, the signal level indicator is a bargraph made up of five rectangular LEDs.

Finally, the left and right outputs from the MC13024 IC are fed to audio amplifier stages. These stages boost the output from the IC and also include 9kHz notch filters. The notch filters remove any 9kHz whistles which can be generated by adjacent stations beating with the received station.

Main circuit

Now take a look Fig.2. This shows the main tuner circuit diagram.

While the circuit looks rather daunting at first glance, it's really not that bad. If you look at the centre of Fig.2, you will find the MC13024 (IC2) and this does most of the work. As we've already pointed out, it is virtually a complete stereo AM tuner on a single chip.

The remainder of the circuitry provides the narrow band station detect function (Q2, CF2 & IC4a-b), the signal level indicator (IC6, IC7 & LEDs 2-6) and the audio output stages (IC3a-d).

The incoming RF signals are picked up by antenna coil L1 which is tuned to resonance at the signal frequency by varicap diode VC1. A 4.7pF capacitor is wired in parallel with VC1 to provide the extra capacitance required to cover the high frequency end of the band.

Another varicap diode, VC2, is used to tune local oscillator coil L2. This varicap is connected in parallel with trimmer C1 which is used to adjust the local oscillator so that it is always exactly 450kHz higher than the signal frequency. This 450kHz difference is equal to the intermediate frequency (IF) of the tuner.

The series 470pF capacitor reduces the capacitive effect of VC2 by up to a factor of 2 at the low frequency end. This is done because the local oscillator tuning range from 972-2097kHz is a 2.16 ratio, while the tuning range of the L1/VC1 antenna circuit from 522-1629kHz represents a 3.12 frequency ratio.

The tuning voltage for the varicap diodes is derived from the microprocessor-based control circuit. This voltage is applied to VC1 via a 100kΩ isolating resistor and to VC2 via a 1MΩ isolating resistor.

In practice, VC1, its two associated capacitors (.01μF and 4.7pF) and the ferrite rod antenna are installed on a small PC board which is mounted on the back of the chassis. The output is taken from the secondary winding on the ferrite rod and fed to the RF input (pin 10) via a length of shielded cable.

DISK DRIVES AT RIDICULOUS PRICES

Hard disk drive package deals with savings of up to $500

NEC 45 Mb AT BUS (IDE)
Special Package deal for both the Drive and an IDE/FDD controller card

Only $495.00

Normally $695.00

You Save $200.00

NEC 115 Mb AT Bus IDE Drive and IDE/FDD Controller Card

Reduced to only $995.00

Normally $1495.00

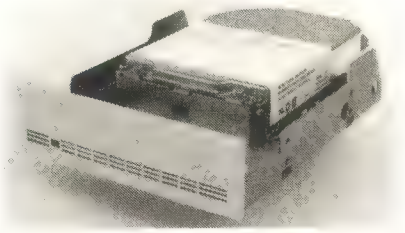
You Save $500.00

NEC 42 Mb MFM Hard Disk Drive and MFM Hard Disk Drive Controller Card

This month only $549.00

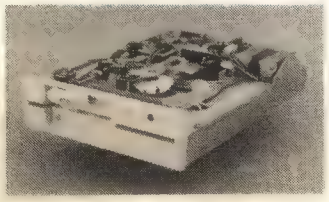
Normally $795.00

You Save $250.00



SAVE $50.00 ON EACH OF THESE FLOPPY DRIVES

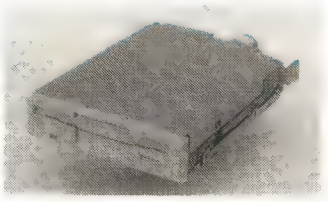
Now is the time to add a second floppy drive to your system



1.2 Mb Floppy Disk Drive

only $125.00

Normally $175.00



1.44 Mb Floppy Disk Drive

only $135.00

Normally $185.00

Notebook Computer - smaller than a ream of A4 paper

80C286 6/12Mhz 286 - Weight only 3.2 kgs

In such a small package you will find many of the features of desktop computers. VGA display which can emulate CGA, EGA, MDA and Hercules mode, as well a fast 25ms 20Mb Hard Disk Drive and 3.5" 1.44Mb floppy disk drive. There is 1Mb of RAM on the motherboard which can be expanded to 8Mb. The built in battery gives more than three hours operation with a built in low battery warning lamp, can also be powered from the mains . As well there are 2 x RS232 serial ports, parallel printer port, external 16 bit expansion port, external VGA socket and external 1.2Mb FDD port.

SX 16Mhz, 40 Mb HDD Available April 1991

Only $3995.00

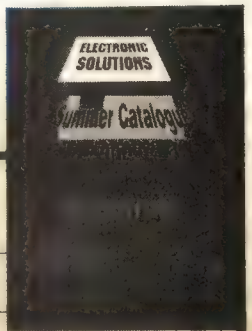
IAN'S PERSONAL GUARANTEE

* All products carry a 14 day money back guarantee (except software and hard disks).
* All prices include sales tax.
* All cards come with full documentation
* All motherboards carry a full 12 month warranty.
* All other products carry a full 3 month warranty.

Due to Technical advances, products we supply may in some cases vary from those pictured. In all cases the products supplied are guaranteed to perform to an equal or higher standard than those pictured

WHOLESALE ENQUIRIES WELCOME

bankcard Card VISA



ELECTRONIC SOLUTIONS

Electronic Solutions
5 Waltham St Artarmon 2064
PO Box 426 Gladesville 2111
Telephone: (02) 906 6666
Fax: (02) 906 5222

Send us this coupon to receive your FREE 1991 Catalogue:

Mr/Mrs/Ms:_____

Address:_____

Suburb:_____ State:_____ Postcode:_____

Note: Please do not send back this coupon if you purchased from us in 1990 or returned the previously issued card to be included on the mailing list (you will receive the catalogue automatically).

02/91

PARTS LIST

1 black rack-mounting case, 44mm high
1 bevelled red Perspex sheet for front panel
1 PC board, code SC01101911, 352 x 120mm
1 PC board, code SC01101912, 341 x 36mm
1 PC board, code SC01101913, 101 x 11mm
1 SPDT plastic rocker switch
10 black pushbutton switches
4 20-way Molex pin strips
1 dual RCA panel socket
1 mains cord & plug
1 cord grip grommet
1 Ferguson PC-mounting transformer, PL12/5VA
1 4 rubber feet
2 solder lugs
1 150mA 3AG fuse
1 piece of Elephantide insulation (352 x 120mm)
1 panel mount fuse holder
5 5mm spacers
1 TO-220 heatsink
13 PC stakes
3 small cable ties
1 4.5MHz parallel resonant crystal
2 5kΩ miniature horizontal trimpots
2 10kΩ miniature horizontal trimpots

Semiconductors

1 D17106-227 microprocessor (IC1)
1 MC13024 AM stereo receiver (IC2)
1 LF347 quad op amp (IC3)
1 LM339 quad comparator (IC4)
1 4066 CMOS quad bilateral switch (IC5)
1 LM324 quad op amp (IC6)
1 LM358 dual op amp (IC7)
1 UA9667 Darlington driver (IC8)
1 4049 hex inverter (IC9)
2 BC548 NPN transistors (Q1,Q2)
5 BC328 PNP transistors (Q3-Q7)
2 BC549 NPN transistors (Q8,Q9)
2 BB212 double varicap diodes (VC1,VC2)
1 BB809 varicap diode (VC3)
4 common anode 7-segment LED displays (red, 13mm high)
13 red rectangular LEDs (LED1-13)
1 LM317 3-terminal regulator (REG1)
2 7805 5V regulators (REG2,REG4)
1 78L05 5V regulator (REG3)
6 1N4002 diodes (D1-D4,D14,D15)
10 1N4148 signal diodes (D5-D13, D16)

Inductors & Filters

1 3/8-inch dia. x 100mm ferrite rod
1 prewound AM broadcast band antenna coil (L1)
1 A7BRS-T1080UH Toko 7P coil (L2)
1 A7NRES-T1341AYN Toko 7P mixer coil (L3)
1 A7NRES-T1340AYN Toko 7P IF coil (L4)
1 A119ANS-18287RS Toko 7P coil (L5)
1 SFP450D Murata ceramic filter (CF1)
1 SFZ450C Murata ceramic filter (CF2)

Capacitors

1 2200µF 25VW axial electrolytic
2 470µF 16VW PC electrolytic
1 100µF 16VW PC electrolytic
2 47µF 16VW PC electrolytic
1 33µF 16VW RBLL electrolytic
1 22µF 16VW PC electrolytic
3 10µF 25VW PC electrolytic
10 10µF 16VW PC electrolytic
1 3.3µF 16VW RBLL electrolytic
1 2.2µF 16VW PC electrolytic
5 1µF 16VW PC electrolytic
1 0.47µF 16VW PC electrolytic
1 0.1µF metallised polyester
1 .068µF metallised polyester
2 .047µF 2% metallised polyester
16 .01µF ceramic
2 .0012µF metallised polyester
1 .001µF ceramic
1 470pF polystyrene
8 270pF 1% polystyrene
1 120pF polystyrene
2 100pF ceramic
2 47pF ceramic
2 22pF ceramic
1 4.7pF NP0 ceramic
2 1.8-22pF trimmers

Resistors (0.25W, 5%)

4 1.8MΩ	6 10kΩ
9 1MΩ	1 8.2kΩ 1%
2 1MΩ 1%	5 4.7kΩ
1 330kΩ 1%	7 3.3kΩ
1 180kΩ 1%	1 2.7kΩ
1 180kΩ	2 2.2kΩ
2 150kΩ	1 1.8kΩ
7 100kΩ	9 1kΩ
4 68kΩ 1%	6 680Ω
2 68kΩ	2 220Ω
2 47kΩ	1 120Ω
4 33kΩ	2 100Ω
2 18kΩ	7 47Ω
1 15kΩ	4 10Ω

Miscellaneous

Shielded cable (1 metre), machine screws & nuts, heatshrink tubing, hookup wire.

Note that the shielded side of the cable connects to the 1V reference of IC2 so that the RF input is biased correctly.

The output from the local oscillator tuned circuit is fed to pin 9 of IC2 via a 10Ω isolating resistor. It also feeds buffer transistor stage Q1 via a 47pF capacitor. The buffered oscillator output appears at the collector of Q1 and is fed to the local oscillator input (pin 18) of IC1.

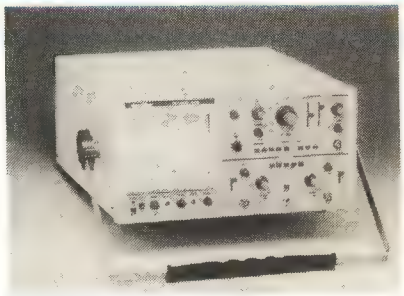
It is this frequency that is compared with the reference frequency derived from IC1 (the microprocessor), as described previously. The error output from the microprocessor controls the tuning voltage and this in turn adjusts the capacitance of VC1 & VC2 so that the tuner locks to the station.

Normally though, a PLL circuit inside IC2 would control the local oscillator. However, as we have just stated, the local oscillator in this circuit (inside IC2) is controlled by a tuning voltage derived from the microprocessor (IC1). This has been achieved by using a high-Q tuned circuit for the local oscillator.

IF stages

The signal from the RF input is amplified and mixed with the local oscillator signal to produce an intermediate frequency (IF) signal of 450kHz. This appears at pin 11 and is resonated in the tuned circuit based on coil L3. A low-impedance tapping on L3 is then used to drive the SFP450D ceramic filter.

ELMEASCO NEWS



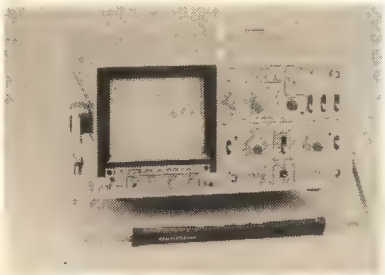
Goldstar Release 100MHz, 3 Channel Scope Under $2000

The new OS-8100 100MHz scope joins the popular Goldstar low cost oscilloscope range. It offers 3 channel, eight trace capability using a new 150mm rectangular CRT with internal graticule. Key features of the OS-8100 include high sensitivity (1mV max) and a bandwidth limiting circuit. For X-Y phase measurements the bandwidth can be expanded. Trigger view is also incorporated together with single sweep.'B' sweep sampling enables improved observation of critical parts of waveforms. A variable 'Hold-Off' circuit and TV sync separation circuits are also provided.

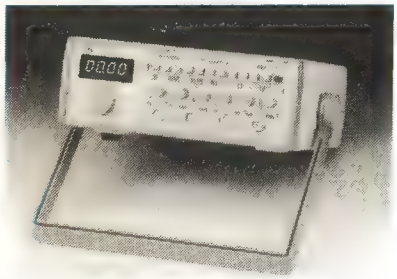
The Goldstar OS-8100 is very competitively priced at **$1950** ex tax

...Joins Popular Scope Range

Goldstar also produce 20MHz and 40MHz dual trace and a 20MHz readout oscilloscope with measuring cursors.



TMI102C Sweep/ Function Generator Has Built-In Frequency Counter

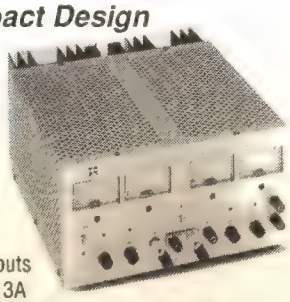


- *0.02Hz to 7MHz in 7 ranges*
- *Multifunction Output with Sweep*
- *Built-In 4 Digit Counter*
- *External Sweep Control*
- *CMOS/TTL Output*
- *<0.5% Distortion from 10Hz to 20kHz*
- *Variable DC Offset*

Order TMIT102C *$340 ex tax*

Low Cost Topward Bench Supplies Have Extensive Metering

- *Tough aluminium cases for good heat dissipation*
- *Constant Voltage & Constant Current Modes*
- *Short Circuit Protection*
- *Single & Triple Outputs*
- *Two or Four Meters*
- *Compact Design*



Model	Outputs
2303	30V 3A
4303	Dual 30V, 3A plus fixed 5V, 3A

Metrix DMMs First To Offer New Level of Safety

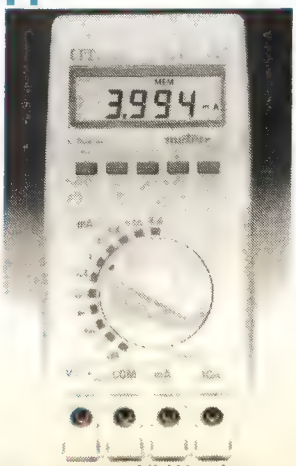
Metrix have announced that their popular MX50 Series digital multimeters have been tested and approved to safety standard VDE411, Class 2.

They are the first manufacturer in the world to gain this approval.

The MX50 Series now carries the VDE logo indicating their compliance to the standard which requires protection against hazards such as electric shock or burn, excessive temperature, liberated gases and explosion or implosion.

Among the safety features of the MX50 Series are fuse protected current ranges – even on the 10A range, totally sealed case (to IP66 standard) and a unique battery and fuse compartment accessed via the front face of the instrument. To gain access it is necessary to disconnect the safety-designed test leads and Secur'X™ adaptor, thereby protecting the operator from accidental contact with hazardous voltages.

Metrix 40 Series Ideal For Harsh Industrial Applications



- *Exceptional All-Weather Performance*
- *Four Year Warranty*
- *4000 Count Resolution*
- *Autoranging with Manual Override*
- *Hold & Peak Functions*
- *True RMS AC or AC+DC*
- *Safe to IEC348 Class 11*

from $220 ex tax

Australia's Leading Test & Measuring Instrument Company

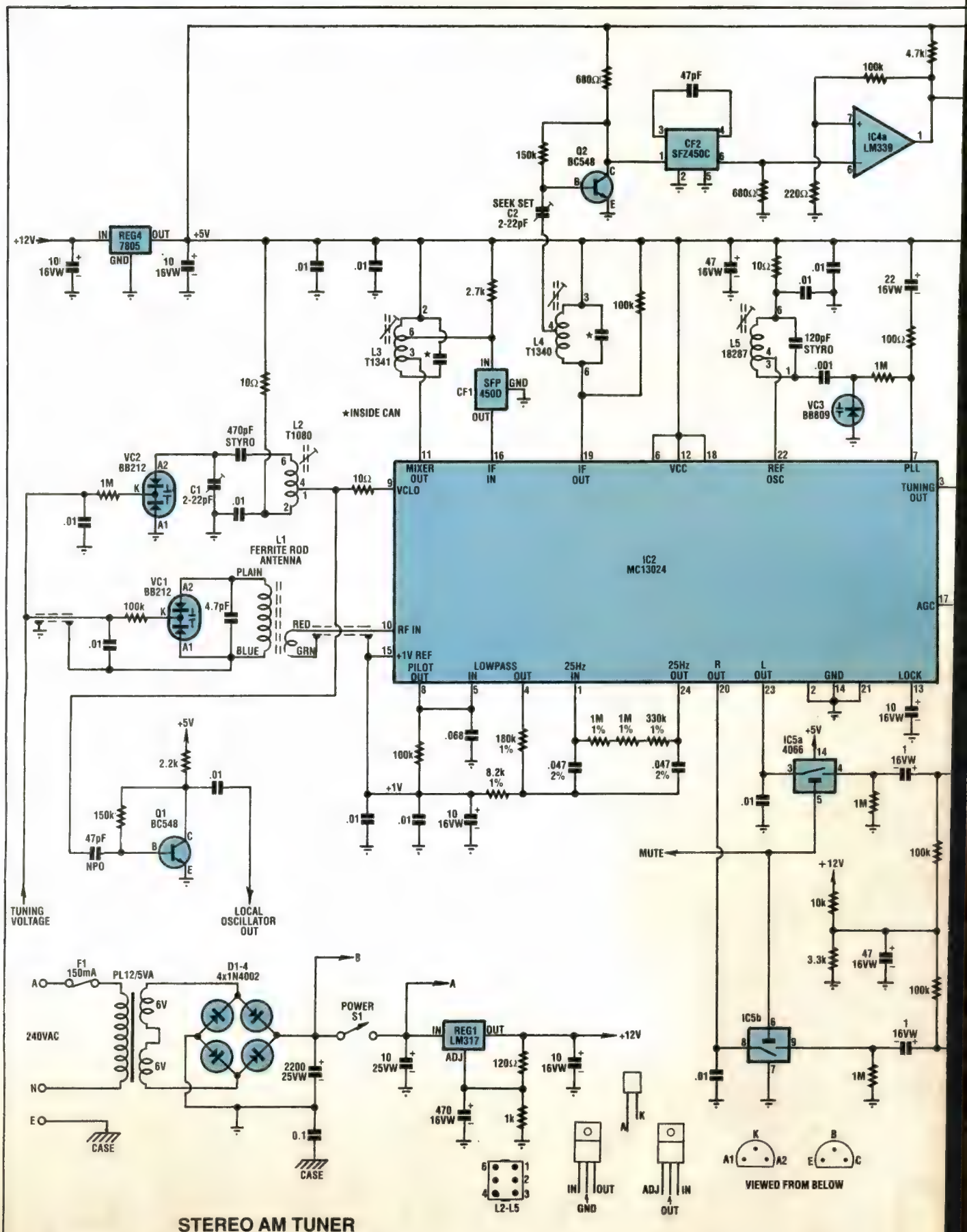
NEW SOUTH WALES
18 Hilly Street,
MORTLAKE
P.O.Box 30, CONCORD
NSW 2137
Tel : (02) 736 2888
Fax : (02) 736 3005

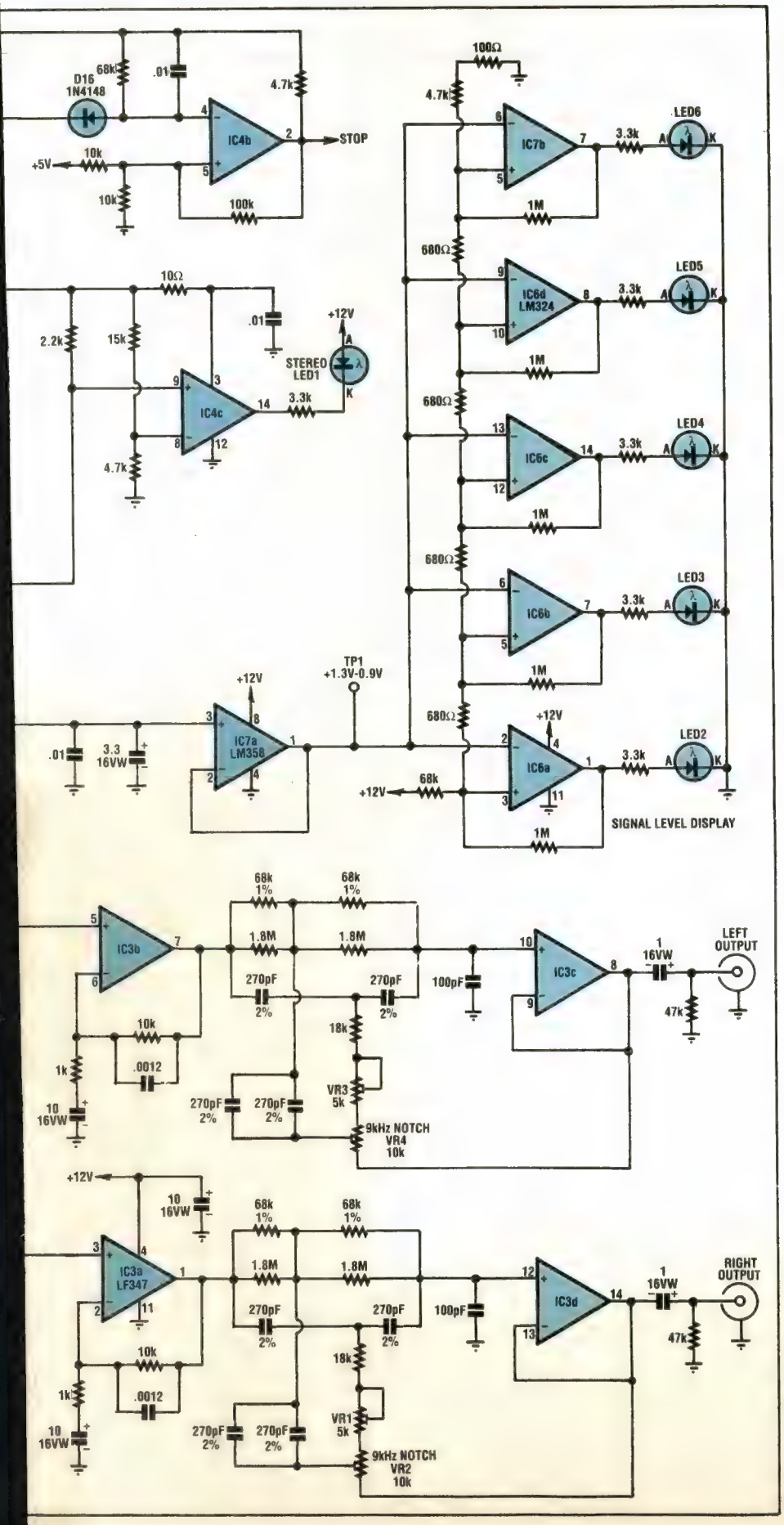
VICTORIA
12 Maroondah Highway,
RINGWOOD
P.O.Box 623, RINGWOOD
VIC 3134
Tel : (03) 879 2322
Telex : AA30418
Fax : (03) 870 8972

QUEENSLAND
192 Evans Road,
SALISBURY
P.O.Box 274 SALISBURY
QLD 4107
Tel : (07) 875 1444
Fax : (07) 277 3753

SOUTH AUSTRALIA
241 Churchill Road,
PROSPECT
P.O.Box 154 PROSPECT
SA 5082
Tel : (08) 344 9000
Telex : AA87519
Fax : (08) 269 6411

W. AUSTRALIA
32 Teddington Road,
VICTORIA PARK,
W.A. 6100
Tel: (09) 470 1855
Fax: (09) 470 3173


+12V
REG4 7805
IN
OUT
GND
+5V
680Ω
47pF
150k
Q2 BC548
CF2 SFZ450C
IC4a LM339
100k
4.7k
220Ω
SEEK SET C2 2-22pF
2.7k
L3 T1341
L4 T1340
100k
CF1 SFP 450D
★INSIDE CAN
10Ω
470pF STYRO
L2 T1080
VC2 BB212
C1 2-22pF
1M
L1 FERRITE ROD ANTENNA
PLAIN
RED
GRN
BLUE
VC1 BB212
4.7pF
100k
MIXER OUT
VCLO
IF IN
IF OUT
VCC
REF OSC
PLL
TUNING OUT
IC2 MC13024
AGC
RF IN
+1V REF
PILOT OUT
LOWPASS IN
LOWPASS OUT
25Hz IN
25Hz OUT
R OUT
L OUT
GND
LOCK
1M 1%
330k 1%
.047 2%
180k 1%
8.2k 1%
.068
+1V
10 16VW
IC5a 4066
IC5b
MUTE
2.2k
150k
Q1 BC548
47pF NPO
TUNING VOLTAGE
LOCAL OSCILLATOR OUT
10k
3.3k
47 16VW
F1 150mA
PL12/5VA
D1-4 4x1N4002
240VAC
6V
2200 25VW
POWER S1
REG1 LM317
ADJ
120Ω
470 16VW
1k
0.1
CASE
L2-L5
VIEWED FROM BELOW
STEREO AM TUNER



The ceramic filter contains four coupled resonant elements and these provide an almost rectangular band-pass characteristic of 450kHz ±12kHz at the -6dB points. Its output is amplified by the 2nd IF stage (inside IC2), the output of which is tuned to 450kHz by coil L4 and its associated internal capacitor (pin 19). A 100kΩ resistor across the coil damps it sufficiently to give the required ±12kHz bandwidth.

Stereo decoding

The output of the IF amplifier is internally connected to an envelope detector, much the same as in a conventional (mono) AM radio. When the MC13024 is in monaural mode, the output from the envelope detector is the L+R signal and this is fed to both audio outputs.

The stereo decoder components comprise the 3.6MHz oscillator, a 25Hz pilot filter, and a lock filter at pin 13.

The 3.6MHz reference oscillator is at pin 22 and is tuned by coil L5 and its parallel 120pF capacitor. Further tuning of this stage is provided by varicap diode VC3 which provides the small frequency shifts necessary to lock the 3.6MHz oscillator to the 450kHz IF signal when a stereo signal is present. The tuning voltage for VC3 is provided by the PLL output at pin 7 of IC2 and, as stated previously, is derived by comparing the phase of the divided 3.6MHz oscillator with the 450kHz IF signal.

When phase lock has been achieved, the decoder will switch to stereo provided the 25Hz pilot tone is present in the demodulated L-R signal. In order to detect this pilot tone, the L-R signal is first fed internally to pin 8 and filtered using a 100kΩ resistor and .068µF capacitor. This re-

Fig.2 (left): the main tuner diagram. Most of the work is done by IC2 which is virtually a complete stereo AM tuner on a single chip. It is tuned by varicap diodes VC1 & VC2 which vary their capacitance according to a control voltage from the microprocessor circuit. Q2, CF2, IC4a & IC4b form the narrow band station detector, while IC6a-d & IC7a,b form the signal level meter.

moves most of the audio but the pilot tone is still too small to be recognised at this stage.

To overcome this problem, the filtered signal is buffered by an amplifier with a gain of two, between pins 5 & 4, and then fed to a high-Q 25Hz bandpass active filter between pins 1 & 24. This effectively extracts the 25Hz pilot tone from the low frequency noise.

The output of the 25Hz bandpass filter at pin 24 goes to the MC13024's pilot tone detector. If the 25Hz tone is present for more than seven consecutive cycles, the decoder switches into stereo mode.

When a new station is selected, the decoder immediately drops out of stereo and then returns to stereo again when the new pilot tone is detected. Because it takes 300ms to count seven cycles of a 25Hz signal, there is a slight time delay before the stereo mode switches in.

IC2's pin 3 output is used to drive the stereo indicator circuit. When no station is present, pin 3 is at +5V. However, if a station is detected, the voltage on pin 3 drops to about 3.5V and, finally, to 0V if a stereo signal is decoded.

Thus, when a stereo signal is detected, pin 9 of comparator IC4c is pulled low and so its pin 14 output goes low and drives stereo indicator LED 1 via a 3.3kΩ resistor. The associated 15kΩ and 4.7kΩ resistors set the voltage on IC4c's inverting input to 1.2V. This ensures that pin 14 can only switch low when pin 3 of IC2 is at 0V; ie, when stereo is detected.

Station detect circuit

Q2, CF2, IC4a & IC4b form the narrow band station detect circuit. Its job is to stop the microprocessor from scanning further up the band as soon as a station is detected, when the tuner is in the seek mode.

A tapping on IF coil L4 provides the signal drive for the station detect circuit. This signal is coupled to the base of common emitter amplifier stage Q2 via trimmer capacitor C2 which sets the sensitivity of the seek function.

The amplified signal is taken from the collector of Q2 and is applied to narrow band ceramic filter CF2. Its output drives the inverting input of comparator stage IC4a. When the input signal exceeds 20mV p-p, IC4a's output swings between the +5V and 0V supply rails. This signal then charges a .01µF capacitor on pin 4 of comparator IC4b via diode D16.

Two 10kΩ resistors set the bias on pin 5 of IC4b to +2.5V, while the 100kΩ feedback resistor sets the hysteresis to about ±240mV. When the voltage on pin 4 drops below +2.26V (due to the .01µF capacitor charging up), pin 2 switches high and delivers the stop signal to IC1. If there is no signal out of CF2 (ie, when tuning between stations), IC4a's output remains high and the .01µF capacitor discharges via a 68kΩ resistor.

Signal level meter

In addition to controlling the gain of the IF and mixer stages, the AGC voltage developed by the MC13024 is made available at pin 17 and is used to drive the signal level indicator. This AGC voltage is first buffered by op amp IC7a which then drives a comparator chain consisting of op amps IC6a-d & IC7b. These drive the five signal level LEDs via 3.3kΩ current limiting resistors.

A resistive divider chain is used to set the voltages on the non-inverting comparator inputs, ranging from 0.8V on pin 6 of IC7b to 1.2V on pin 3 of IC6a. Thus, all the LEDs will be on for AGC voltages of less than 0.8V, indicating a strong signal, while all the LEDs will be off for AGC voltages of greater than 1.2V. For voltages in between these values, one of more of the LEDs will be lit to indicate the relative signal strength.

The 1MΩ resistors connected between the outputs and non-inverting inputs provide a small amount of hysteresis for each comparator. This is done to prevent the LEDs from flickering at the threshold points.

Audio output stages

The audio outputs appear at pins 20 & 23 of IC2 and are shunted by .01µF capacitors to filter out high frequency noise. The left and right channels are then fed to op amps IC3a & IC3b via CMOS gates IC5b & IC5a respectively. These CMOS gates switch the signal through when the mute signal from the microprocessor is high (ie, when a station is detected) but go open circuit to mute the output when the control input is low (ie, during tuning and at power up or power down).

IC3a & IC3b both operate with a gain of 11, as set by their 10kΩ & 1kΩ feedback resistors. A .0012µF capacitor across each 10kΩ feedback resistor sets the upper frequency rolloff to about 13kHz.

Immediately following the amplifiers are the twin-T filter networks, based on IC3c, IC3d and their associated close-tolerance RC networks. These twin-T filters provide a sharp notch at 9kHz, to filter out signal beats from adjacent stations. VR1 & VR3 allow the total resistance in the bottom leg of each twin-T filter to be adjusted to the correct value, while VR2 & VR4 allow precise setting of the notch frequency.

The 100pF capacitors on the non-inverting inputs of IC3c & IC3d are there to prevent instability in the twin-T filters, and to provide a small amount of high frequency cut above 12kHz.

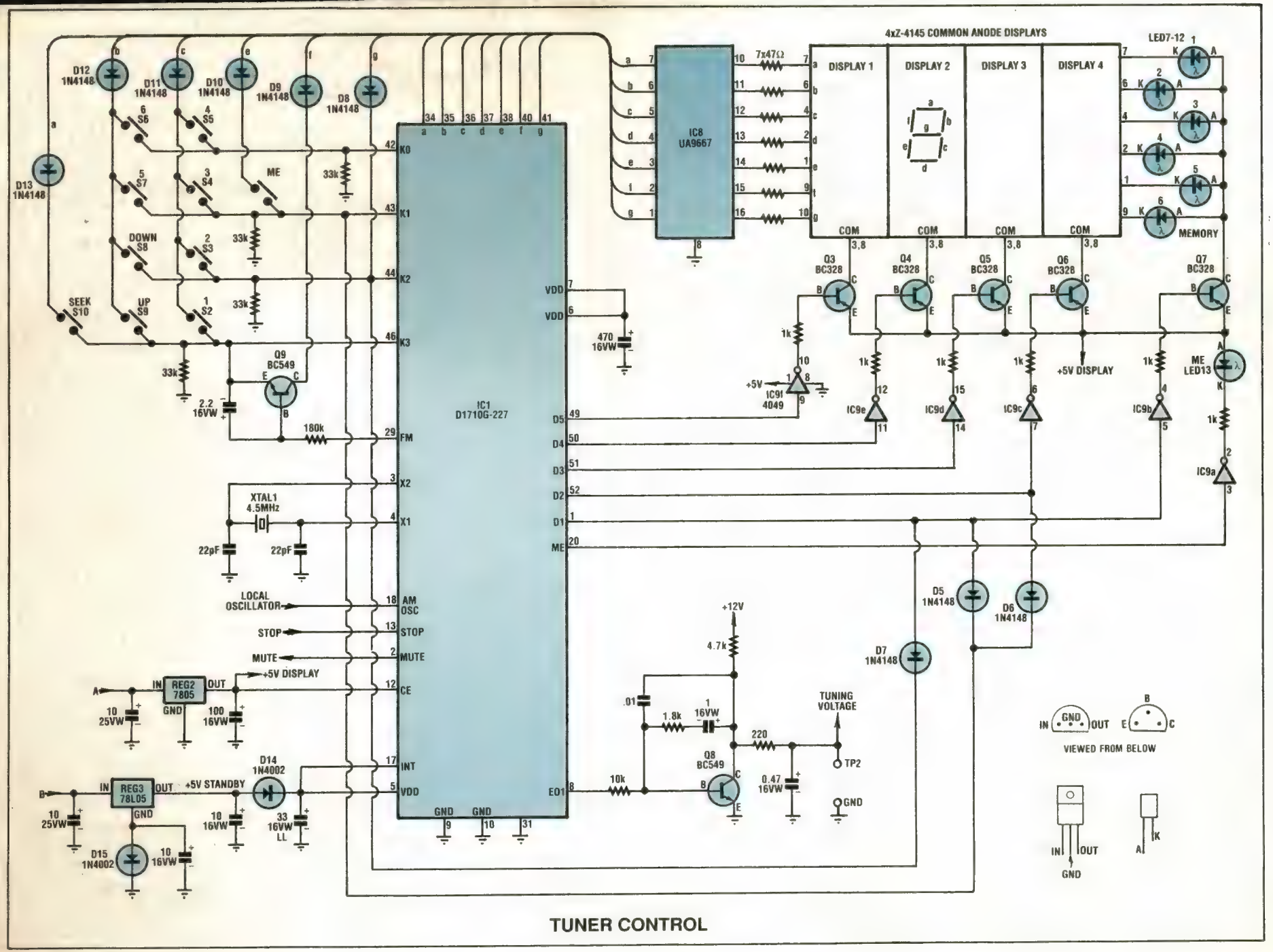
Control circuit

Now let's take a look at the control circuit for the new tuner, shown in Fig.3.

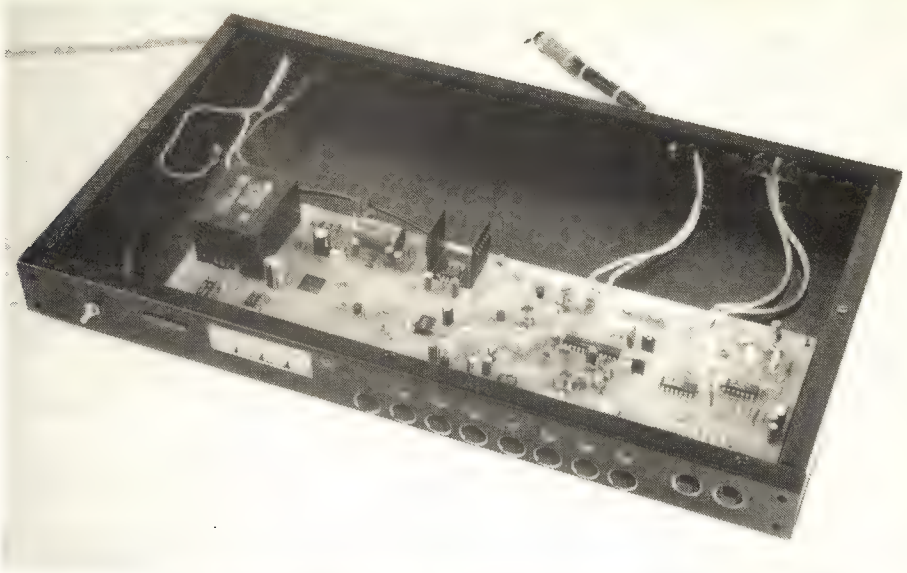
At the heart of the control circuit is IC1 which is a standard NEC tuner control chip. Among other things, it provides the tuner control voltage and drives the 7-segment LED displays and memory LEDs in multiplex fashion.

The Sa-Sg outputs drive the display segments and memory LEDs via Darlington buffer IC8 (UA96677), while the D1-D5 outputs drive inverter stages IC9b-IC9f. These in-

Fig.3 (right): the control circuit is based on microprocessor IC1. It's basically a phase lock loop that compares the local oscillator signal with a divided reference frequency & produces an error voltage at pin 8. This error voltage is then buffered by Q8 to give the tuning voltage for the varicap diodes in the tuner front end. IC1 also drives the LED displays & decodes the switch inputs.



TUNER CONTROL



This view shows the completed tuner, minus its silk-screened front panel. It's easy to build & delivers superb stereo AM performance.

verters then drive transistors Q3-Q7 which switch the display digits and the memory LEDs.

The ME or 'memory enable' output drives the ME LED via inverter IC9a and a 1kΩ resistor.

In addition to driving the display segments, the Sa, Sb, Sc, Se, Sf & Sg outputs drive the switch matrix via isolating diodes D8-D13. The other sides of the switches are connected to the K0-K3 inputs of IC1, which are normally pulled low via 33kΩ pull-down resistors. However, if a switch is pressed, one of the segment outputs will pull the corresponding K0-K3 input high and the switch function is then decoded and executed by the microprocessor.

Also connected to the K1 & K2 inputs are feature selection diodes D5-D7. These are driven by the D1 & D2 outputs of IC1 and are used to select various options; eg, 9kHz or 10kHz station spacing, discrete LEDs or a 7-segment display for memory indication, etc.

Because IC1 is designed to control both AM and FM tuners, it always comes on in FM mode when power is initially applied. Since we want to control an AM tuner only, Q9 has been included to automatically switch IC1 back into AM mode.

It works quite simply. When power is first applied, pin 29 of IC1 goes high and turns on Q9 after a brief delay, as set by the 2.2µF capacitor. This in turn allows Sf to pull the K3 input high, which is the command for IC1 to switch to AM control.

A 4.5MHz crystal (X1), connected to pins 3 & 4, provides the timebase for the IC1 and this is loaded by two 22pF capacitors to ensure optimum operating conditions.

Pin 8 (EO1) is the error output and this drives buffer stage Q8 via a 10kΩ resistor. The output appears at the collector of Q8 and, after filtering, provides the tuning voltage for the varicap diodes in the tuner front end. The .01µF capacitor reduces high-frequency noise on the collector of Q8, while the series 1.8kΩ resistor and 1µF capacitor form a low-pass filter.

Other inputs and outputs are the stop input (pin 13), the local oscillator input (pin 18) and the mute output (pin 2). The oscillator input is derived from buffer stage Q1 on the main tuner circuit (Fig.2) as discussed previously, while the mute output controls CMOS switches IC5a & IC5b.

Power supply

Power for the AM Stereo Tuner is derived from a mains transformer which provides 12VAC at 5VA (see Fig.2). This drives bridge rectifier D1-D4 and the resulting DC output filtered by a 2200µF capacitor to give an unregulated supply rail of about 17V. This 17V rail is then used to drive a number of 3-terminal regulators.

For the main tuner circuit, the 17V rail is switched by S1 and fed to adjustable 3-terminal regulator REG1 to derive a regulated +12V supply rail. This +12V supply is used to power most of the op amp and comparator circuitry and also supplies the collector of Q8 via a 4.7kΩ resistor. It also drives REG4 which provides a +5V rail to power IC2, IC4 & IC5.

Note the 470µF capacitor across the 1kΩ voltage adjust resistor on REG1. This ensures a slow turn on to prevent large thuds in the audio output when power is first applied. (You can't get slow turn-on from a 7812 but with a capacitor on the ADJ terminal, you can with an LM317).

The 0.1µF capacitor connected between chassis and circuit earth is necessary to keep the circuit earth at the same AC potential as the chassis. Without this capacitor, the sensitive 25Hz pilot detector in IC2 would be overloaded by 50Hz mains signal and there would be no stereo reception.

Two separate supplies are used to power the microprocessor chip (IC1) - see Fig.3 again. First, a +5V supply is derived via REG3 from the unswitched side of S1 and this is applied to pins 5 & 17 via D14. This standby supply is on permanently (unless the mains is switched off at the wall socket) and keeps the microprocessor powered up to maintain the station memories when the tuner is switched off.

If the mains supply is interrupted (or the tuner is switched off at the wall), the 33µF low leakage capacitor at pins 5 & 17 maintains the standby supply for several hours, to ensure that station settings are not lost.

Diode D14 prevents the 33µF capacitor from rapidly discharging back into the regulator if the mains supply does fail. To compensate for the voltage drop across this diode, diode D15 jacks up the output of REG3 to 5.6V.

The second +5V supply rail for the microprocessor is derived from the switched side of S1 and is fed to the chip enable (CE) input via REG2. This supply rail is also used to power the LED displays.

At first glance, the use of four separate regulators may seem unnecessary. Why not just use two: one to provide the +12V rail and another to power all the +5V circuitry? The answer is that separate +5V regulators are necessary to keep the multiplex noise generated by the control circuitry out of the sensitive tuner circuits.

That's all we have space for this month. Next month, we will continue with the full construction details. SC

JAYCAR - No 1 for NEW products

Economy Digital Multimeter

17 range DMM at a price that must be the lowest in Australia. Who would have thought you could buy a quality DMM for under $35! Compact size which is ideal for tool boxes, glove compartments etc. Uses a 9V 216 type battery for long life (100 hours).

FEATURES

- 3.5 digit LCD display
- 3 range battery checker
- Diode test
- Compact size 116(L) x 70(W)x24(H)mm
- Easy re-calibration instructions supplied

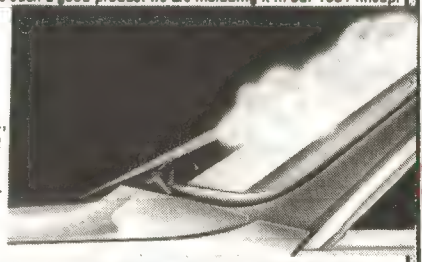
Cat. QM-1430

$34.95

HOT JET

Hot Water for Car Windscreen Washers

This product is not electronic, but it is such a good product we are including it in our 1991 lineup.



We all know how much better it is washing dishes with hot water compared to cold water.

Now imagine this same principle on your car windscreen which has got road grime, grease, dust, insects, etc., all over it. The difference is chalk and cheese. One wonders why this wasn't thought of before - and it's so simple. You can install it in minutes. The water reservoir mounts on your radiator hose (cable ties supplied) and you simply cut the hoses going to the windscreen washer and re-route through the reservoir. Additional hosing supplied. That's all there is to it. Should take you all of 5 minutes.

Made in England and imported by Jaycar.

Cat. XJ-2000

$14.95

HOT JET

NEW FOR 1991

COUNTDOWN TIMER

Brand new improved model for 1991. The LCD timer is easily preset from 1 minute to 15 hours 59 minutes. Hit the start button and it will count down the time length desired.

Two alarm signals are sounded, 10 minutes and 5 minutes before time is up. When it reaches "zero" the alarm will sound for 20 seconds.

Ideal for a host of things - e.g. PC board etching time, boiling your eggs, parking meter reminder, hose left on reminder, photography, cooking, etc., etc.

Size - diameter 60mm, depth 12mm. Supplied with a tilting bail to standup, a magnet to attach to the fridge and a clip to attach to note boards etc.

Uses a G13 battery supplied.

Cat. XC-0135

$12.95

THE FLYING DUCK

Indoor TV Antenna

This brand new design indoor antenna will pick up almost anything! Well, almost!!

It is omnidirectional and polarised and will pickup AM/FM/VHF and UHF. Frequency range is 100MHz - 960MHz.

It is easily adjusted for either horizontal or vertical polarisation signals - just turn it around.

It is supplied with 12 velcro sticky pads on the underside for easy mounting on a wall or window. Size is 280(w) x 240(H) x 12(D)mm.

Supplied with 3 metres of coax and a standard 75 Ω TV plug.

Cat. LT-3135

$37.95

NEW FOR 1991

DIODE BARGAIN

BA318 (Low Voltage 1N914)

Comparison Chart	VR V	IFmA	trr ns
BA318	50	100	4
1N914	75	75	4

Packet of 100 1N914 sells for $4.95

Stock up now at the bargain price of only $2.95 for 100 pcs.

Cat. ZR-1108

PEDOMETER

Multifunction Step Counter Plus Clock

The new pedometer is a sophisticated device used to measure the total distance travelled by walking or jogging. Simply programme in your stride length and it calculates the rest. It will advise you how many steps you've gone (up to 99999) or how far you have travelled in kilometres. Unit simply clips over the top of your pants and has a top display for easy reading.

Also incorporates a 12 or 24 hour format clock.

Cat. QM-7225 **ONLY $16.95**

NEW FOR 1991

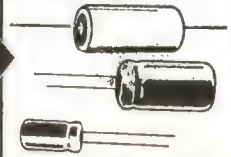
MIXED ELECTROLYTIC CAPACITOR PACK

Back again, after an absence of some months. And it's bigger and better than before.

The pack contains approximately 100 capacitors in RB and RT styles and there's even some Bi-polars and an RP style. The RP style is a 3300μF 80V worth $5 by itself.

This pack represents an absolute bargain. 100 capacitors for $10 is only 10¢ per cap and our cheapest electro costs 28¢.

Cat. RE-6280 **$10**



VHS Video Tape Case

Commonly referred to as a V-0. It's basically a standard VHS video cassette, but without the tape.

Ideal way to repair a precious tape that has broken, or the case is damaged.

Cat. AR-1435

$3.95

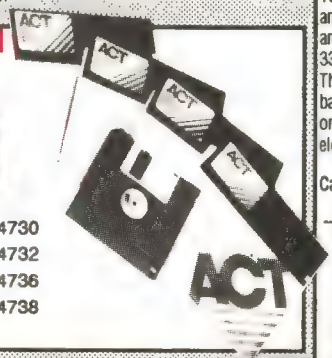
10+ $3.70 each

NEW FOR 1991

ACT DISKS AT EVEN LOWER PRICES

Cheapest in Australia?

	Pkt 10	1990 Price	Cat
5.25" DSDD	$5.10	$6.50	XC-4730
5.25" DSHD	$10.50	$15.95	XC-4732
3.5" MF2DD	$9.75	$16.95	XC-4736
3.5" MF2HD	$24.95	$34.95	XC-4738



PROGRAMMABLE TIMER/CLOCK

NEW FOR 1991

This timer really does the lot. It will count up or down anywhere from one second to 99 hours 59 minutes and 59 seconds. When the time has elapsed an alarm sounds for 60 seconds and the timer counts again from 0.00 with the "Time Up" flag, so you know how long it's been since the alarm sounded.

It has four separate programmable count down time timers. Each will time up to 99 hours and the four can be programmed and set at once for different times., e.g. T1 - 1 hour, T2 2.5 hours, T3 10 minutes and T4 3 minutes all starting at the same time.

The clock shows hour, minute and second together with AM, PM indicator and 12 or 24 hour selectable mode.

Size 70(W) x 60(H) x 15(D)mm. Supplied with a tilting bail to standup, a magnet to attach to the fridge and a clip to attach to note boards etc. Uses a LR44 battery supplied.

Cat. XC-0140 **$24.95**

NEW CATALOGUE NEXT MONTH

ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR

ELECTRONICSJAYCAR

PRO SERIES HI FI KIT BARGAINS

This is your chance to save BIG bucks on our top of the range Hi Fi kits.

BARGAIN No 1

Pro Series Power Amp (Ref: EA Dec 89)
140W RMS stereo amp kit with distortion at 0.007% at full power
Cat. KA-1725 **$599**

Pro Series Hi Fi Preamp (Ref: EA Oct 90)
Super Hi Fi quality. Max distortion 0.002% Signal to noise up to 115dB
Cat. KA-1730 **$329**

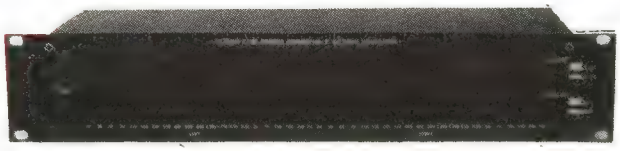
Total $928

BUY BOTH FOR $849 SAVE $79

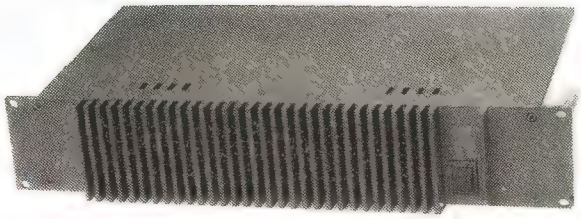
BARGAIN No 2

Pro Series Power Amp $599
Pro Series PreAmp $329
Studio Series Half Octave Stereo Equaliser Kit $349
(Ref: Silicon Chip Sept 89)
Distortion typically better than 0.001% Cat. KC-5055

Total $1277



BUY ALL THREE FOR $1099 SAVE $178



Please Note
If demand exceeds current stock we will ship what we have so you can get started on the building of the kit(s). The balance of the kit(s) will then be sent as soon as possible.

NEW JAYCAR STORE FOR MELBOURNE 266 SYDNEY ROAD COBURG

Please phone A'Beckett Street on
(03) 663 2030 or Springvale on
(03) 547 1022 to obtain Coburg's telephone number
AMPLE PARKING AT REAR OF SHOP

ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICS JAYCAR ELECTRON

COMPUTER MOUSE MAT

- Antistatic rubber mat
- Sensitive and accurate
- Makes a comfortable tracking
- Prevents mouse from dust, dirt and dampness
- Rubber backing to avoid slipping off mat
- Size 220mm x 260mm

NEW FOR 1991

Cat. XM-5095

ONLY $8.95

OUR BEST SELLING 3.5 DIGIT MULTIMETER

Meter includes:
- Frequency counter, capacitance, transistor tester, 20 amp current, ohms, AC/DC voltage, high impact case - for full specs see 1990 catalogue.

Cat. QM-1555

USUALLY $149.50

NOW $129.50

SAVE $20

LOUDSPEAKER PA BIN ENCLOSURE DESIGNS BOOK

Finally a book that is totally comprehensive explaining everything you want to know about building speaker boxes, wiring, crossover, impedance matching, etc. Cat. BF-4150

FANTASTIC VALUE AT $19.95

HOWEVER, THIS MONTH PAY

ONLY $14.95

SAVE $5

16 DRAWER PARTS CABINET

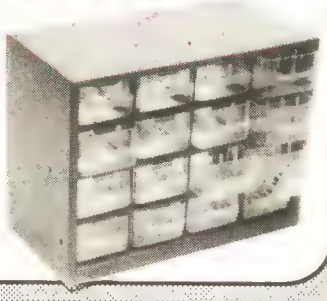
Designed to hold all your electronic bits and pieces. The unit is grey with clear drawers. Key holes at rear of box for easy wall mounting. Dividers supplied. Total size 185(H) x 242(W) x 124(D)mm.

Cat. HB-6320

WAS $12.95

NOW $9.95

SAVE $3



ULTRA LIGHT WALKMAN HEADPHONES

Quality phones with a 3.5mm stereo plug and also a 6.5mm adaptor supplied. **This must be the cheapest price around.**

Cat. AA-2016

WAS $8.95

NOW $4.95

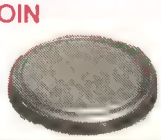
SAVE $4

JAYCAR NOW STOCKS THE TWO MOST POPULAR LITHIUM BATTERIES - THEY ARE 3 VOLT AND ABOUT THE SIZE OF A 5 CENT COIN

CR 2025 Cat. SB-2520

CR-2032 Cat. SB-2522

$3.50 ea



NEW FOR 1991

HIGH QUALITY MULTIMETER LEADS

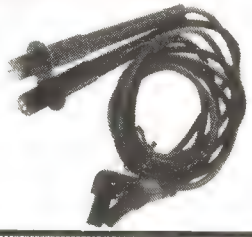
- These are the same leads that are supplied with our Metex meters
- Supplied with heavy duty cable
- Right angle banana plugs with plastic sleeve
- Finger protectors built in probes

Cat. WT-5318

WAS $8.95

NOW $6.95

SAVE $2



PLASTIC SUCTION VICES

- Strong suction base allows easy portability
- Single action lever to secure or release suction
- Plastic jaws with metal pads

Cat. TH-1848

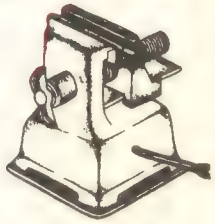
WAS $6.95 NOW $4.95 SAVE $2

Size 85 x 65 x 60mm

Cat. TH-1849

WAS $9.95 NOW $7.95 SAVE $2

Size 80 x 80 x 90mm



LOGIC TESTER

Quality logic probe - will test all logic families (TTL, LS, CMOS, etc). Pulse/normal switch to indicate pulse or continuous signals. For full specs see 1990 catalogue.

Cat. QT-2210

WAS $29.95 NOW $24.95

SAVE $5

30 PIECE ENGINEER'S DRIVER SET

- 5 slotted bits • 5 hex bits • 4 Philips bits • 4 square recess bits • 6 Torx bits • 2 Pozidrive bits • 1 x 1/4" drive socket adaptor • 1 x 1/4" drive hex bit holder - all in a tough plastic case

Cat. TD-2000

WAS $19.95 NOW

$14.95 SAVE $5

GREAT VALUE

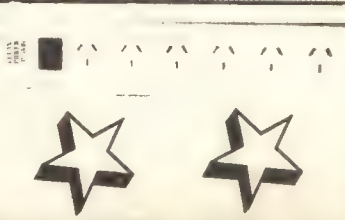
6 WAY POWER OUTLET WITH MAINS FILTER

This power board incorporates a voltage surge and spike protector and noise rejection filter network. Supplied with two metre cord and mains plug. Safety shutters on each outlet, illuminated master on/off switch and even a safety circuit breaker. Ideal for computers, Hi Fi, etc.

Cat. MS-4030

USUALLY $59.95

NOW ONLY $49.95 SAVE $10



TURN YOUR SURPLUS STOCK INTO CASH!!

Jaycar will purchase your surplus stocks of components and equipment. We are continually on the lookout for sources of prime quality merchandise

CALL MARK HARRIS OR BRUCE ROUTLEY NOW ON (02) 747 2022

ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICS JAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICS JAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICS JAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICS JAYCAR

COMPUTER BITS

BY JENNIFER BONNITCHA

Why it takes so long to turn on

Ever wondered why your computer takes so long between the time you turn it on and the time when it is actually ready to do your bidding? This month we explain why.

Start-up is a very busy time in the day-to-day life of your PC. One of the most important activities is the POST (Power On Self Test) which is a series of program routines, buried in the motherboard ROM (Read Only Memory). POST tests all the main system components at power-on time and is the reason why there is some delay between turning the computer's power on and actually using it; all tests are executed before the computer loads the operating system.

The procedure tests all the primary computer components such as the CPU (Central Processing Unit - the "brains" of your computer), ROM, motherboard support circuitry, memory and major peripheral devices such as printers. However, the tests are brief in nature, to the extent that the POST process can provide error or warning messages when a faulty component is encountered, either by sounding a tone and/or displaying a message.

Almost all manufacturers also display the system memory as it is tested. The last number you see (eg, 640KB OK) is the amount of memory correctly tested and the number should agree with the total amount of memory installed in your computer. Alternatively, you may see "conventional" then extended memory tested and reported as separate amounts.

Watch next time you boot your computer and note also that expanded memory is not tested by the POST, nor does it count in the numbers reported. For a discussion of PC memory usage, refer to Brian Richard's article in the December 1990 issue of SILICON CHIP.

POST error codes

POST error codes usually provide tones with varying combinations of beeps to identify the faulty component. If an error is detected during the POST procedure, an error message displays. These messages are usually in the form of a numeric code several digits long and will again depend on your computer's manufacturer. Normal POST completion sounds one short beep when the system starts. If any problems are encountered, you will probably get the tones shown in Table 1 but, as always, watch the screen and check the manual:

In addition to the POST, general diagnostics and advanced diagnostics are available for most PCs.

Table 1: Error Tones

TONE	PROBABLE FAULT
No beep	Power supply
Continuous beep	Power supply
Repeating short beeps	Power supply
1 long, 1 short beep	Motherboard
1 long, 2 short beeps	Video adpator card
1 short beep, bad/no display	Video cable &/or display
1 short beep, no boot sequence	Disc cable, adaptor drive

Diagnostics discs

The manufacturer's System Diagnostics Disc (or equivalent) enables you to test various parts of your computer system, including the system unit and many installed options such as the expansion unit, keyboard, display, printer and so on. You often need to boot from the diagnostics disc to run the programs since a special version of DOS (Disk Operating System) resides on the disc.

Of particular interest is the suppression of system parity checking during the boot process using this disc. A normal system may be continually locked up with a memory parity-check error. By disabling the check, a defective system may be able to "limp" through the diagnostics.

For "technician level" diagnostics, the Advanced Diagnostics or the equivalent provide the "real" diagnostic programs which produce error messages in the form of numbers. Since many manufacturers offer their own versions of diagnostics programs, you should use those provided. If your system does not have this type of manufacturer support, you can generally use the IBM diagnostics.

Nearly all PC error codes for the POST are represented by the device number followed by two digits other than 00. The device number plus 00 is used to indicate successful completion of a test. Typical error codes are shown in Table 2.

The Advanced Diagnostics do a good job with the system components, however these programs fall short when testing disc drives. Drives are the cause of the vast majority of problems in computer systems, so it is worthwhile finding a program to test not only the disc's data but also characteristics such as the drive's alignment.

While many programs can evaluate the condition of, say, a floppy disc, not many can evaluate the condition of the drive itself. To do this, you need a disc created by a specially calibrated machine. This disc, which contains certain known errors, can then determine the capabilities of the drive against the disc in conjunction with the appropriate software. Errors can include sectors that are progressively further from the precise track centre, so the ability of the drive to read these intentionally off-centre sectors is used to guage the drive's alignment.

Basic booting

As the computer initialises, ROM performs the POST and reads the contents of the Basic Input/Output System (BIOS). The function of the BIOS.SYS file is to talk to the system's peripherals. The IBM PC of old also contained Cassette BASIC, so if all else failed, you could play around with BASIC. Placing a small, but very essential part of start-up procedure in ROM allows the computer to boot itself automatically and yet remain flexible for future changes.

While an in-depth knowledge of the various kinds of ROM is useful perhaps to a programmer, at some stage it is likely you may need to know which version of ROM is installed in your computer. New ROM versions deal with the ability to interface to the enhanced 101 keyboard, 5.25-inch 1.2Mb drive, 3.5-inch 720Kb and 1.44Mb drives, hard disc types etc. Subtle differences hidden in your system can often be the cause of some strange problems.

ROM version can be tracked through programs such as Norton Utilities and at a basic level through observation at boot time. For example, Phoenix Software manufactures compatible ROM BIOS chips for compatible motherboard manufacturers. A typical display is as follows:

Phoenix 80286 ROM BIOS Ver. 3.05TB
Copyright (c) 1985,1986 Phoenix Technologies Ltd.
All Rights Reserved.

If the display changes too quickly for you to read the information, try pressing ^S (hold down Ctrl and press the letter S) or the Pause key on the 101 enhanced keyboard.

Disc duties

Having satisfied itself that the POST memory and hardware tests are complete, the next phase in the boot sequence is to search for a system disc with the operating system on it. A

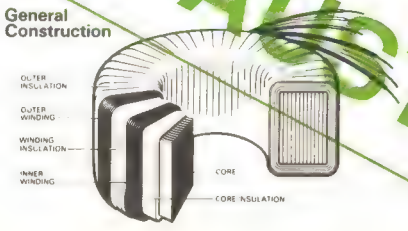
ANTRIM

TOROIDAL TRANSFORMERS

QUALITY TOROIDAL POWER TRANSFORMERS, MANUFACTURED IN U.K. NOW AVAILABLE EX-STOCK AT REALISTIC PRICES.

NOW AUSTRALIAN MADE

General Construction

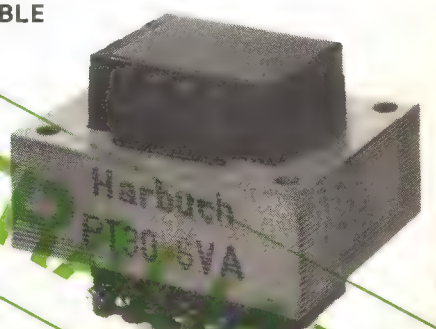


We are the largest ex-stock supplier of toroidal power transformers in Australia. Our standard range consists of the U.K. manufactured ANTRIM range in 10 VA sizes from 15VA to 625VA. All have a single 240V primary and dual secondary windings ranging from 2 x 6V to 2 x 55V. Our local manufacturing facilities supplement this range by manufacturing specials to order. Models are available from stock to suit most project kits. Comprehensive data sheets are available on request. Enquiries from resellers and manufacturers are welcomed. Prices are extremely competitive and generous trade discounts apply for quantity.

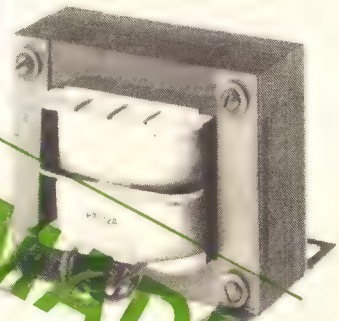
E–I LAMINATED POWER TRANSFORMERS

PCB MOUNT STOCK RANGE

PCB mount ex-stock in sizes from 2.5VA to 25VA with secondary voltages from 2 x 6V to 2 x 20V. Triple output models also available for logic circuits. Chassis mount manufactured to order in sizes from 2.5VA to 1KVA in E-I and C core.



CHASSIS MOUNT TO ORDER



HARBUCH ELECTRONICS PTY LTD
90 George St., HORNSBY NSW 2077 Phone (02)476-5854

disc qualifies if it has a boot record on the first track of the disc to indicate the presence of the hidden system files IO.COM and DOS.COM - machine language COMmand files. Should the first available disc not contain these two hidden files - you accidentally leave a disc in Drive A, for example - a NON SYSTEM DISK message displays.

The first hidden file is IO.COM (or IBMIO.COM if you have the real article). This file contains extensions to the ROM BIOS routines and so by interfacing with it, can pass instructions to the processor and so determine equipment status, initialise peripherals, etc. It also loads the COMMAND.COM file into its allotted memory address.

The second hidden file is MSDOS.COM (IBMDOS.COM). This file contains the DOS service routines which are the next level of system software up from ROM BIOS. Its functions include performing I/O (input/output) operations to various devices, initialising the working tables of DOS, and performing its interrupt functions. Additionally, DOS.COM determines the lowest available address for COMMAND.COM to be loaded into Random Access Memory (RAM).

CONFIG.SYS file

Next, the contents of the CONFIG.SYS file are read from the system disc. SYS files are used by the operating system and they can hold software routines that control and communicate with the computer's devices or peripherals. This file generally contains default values for the operating system and information on required device drivers.

The command processor COMMAND.COM is the highest level of DOS and its job is to interpret the commands a user enters through the keyboard and control the internal DOS commands. The internal commands are frequently-used DOS commands such as COPY, DIR, DEL etc that are kept in RAM. COMMAND.COM can't control external commands such as FORMAT, CHKDSK, etc and they must be loaded into memory from a disc whenever they are issued by the user.

Executable files

COM files are machine language command files. Thus, whenever you type a DOS command, DOS searches the disc and any path you set for a file with that command name. If the search fails, DOS then searches for a file with the same name and an EXE (EXEcutable) extension. You could say that binary notation EXE files are second-level command files since they are used less frequently than the COM files.

Finally, if an AUTOEXEC.BAT file is found, the information contained within is processed and the computer is ready for use.

Next month, we'll have a look at the CONFIG.SYS and ANSI.SYS files, together with a whole host of environment settings you can try on your computer. But be warned: the earlier your DOS version, the less you can try. **SC**

Table 2: Typical Error Codes

CODE	DESCRIPTION
01x	Undetermined problem
02x	Power supply
1xx	System board
2xx	Memory (RAM)
3xx	Keyboard
4xx	Monochrome Display Adaptor (MDA)
5xx	Colour Graphics Adaptor (CGA)
6xx	Floppy drive/adaptor
7xx	8087, 80287 or 80387 math co-processor
9xx	Parallel printer adaptor
10xx	Alternate parallel printer adaptor
11xx	Asynchronous communications adaptor
12xx	Alternate asynchronous communications adaptor
13xx	Game control adaptor
14xx	Matrix printer
15xx	Synchronous Data Line Control (SDLC) communications adaptor
16xx	Display emulation (327x, 5520, 525x)
17xx	Fixed disc
18xx	I/O expansion unit
19xx	3270 PC attachment card
20xx	Binary synchronous communications (BSC) adaptor
21xx	Alternate binary synchronous communications adaptor
22xx	Cluster adaptor
24xx	Enhanced Graphics Adaptor (EGA)
26xx	XT/370 errors
27xx	AT/370 errors
28xx	3278/79 emulation adaptor
29xx	Colour/graphics printer
30xx	Primary PC network adaptor
31xx	Secondary PC network adaptor
33xx	Compact printer errors
36xx	General Purpose Interface Bus (GPIB) adaptor
38xx	Data acquisition adaptor
39xx	Professional graphics controller
71xx	Voice communications adaptor
73xx	3.5-inch external disk drive
85xx	IBM Expanded Memory Adaptor (XMA)
89xx	Music feature card

VINTAGE RADIO

By JOHN HILL

One thing leads to another

It's funny how one simple act can lead to a series of events that probably would not have otherwise happened. In my case, these so-called events were well overdue and it was about time something was done anyway.

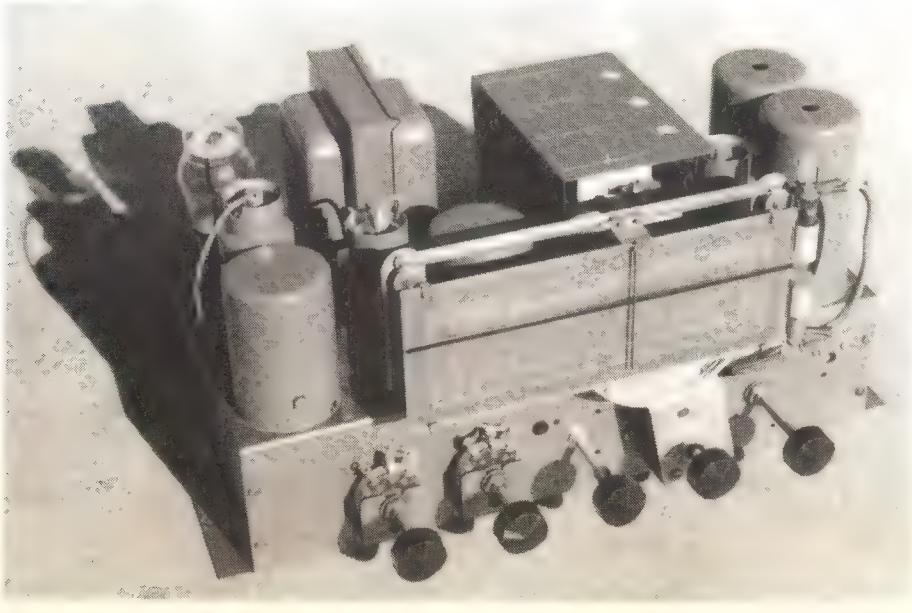
It all started when I was looking for a potentiometer. I have hundreds of these items in various shapes and sizes and while looking for one particular pot I kept finding others. I was surprised to discover that I had so many wirewound types and these were put to one side rather than mix them up again with the other potentiometers.

I eventually found what I was looking for and put the wirewound assortment into a box to be inspected at a later date. As my potentiometer collection is mostly secondhand, such pots need a thorough clean and checkout before they can be put back into service. In many cases, they don't make the grade.

This particularly applies to old and used wirewound potentiometers. Not only are they secondhand but they are also often well worn, dirty and clogged up with dry grease. Checking and reconditioning these old pots seemed like a good idea for they would then be ready to use when needed.

Wirewound potentiometers were used as volume controls in early superhet receivers up to about the mid-1930s, before the advent of AVC (automatic volume control). The usual setup was to place the volume control in the cathode circuit of the intermediate frequency amplifier valve(s) and, in some instances, the frequency converter valve as well (but not in an autodyne). A variable resistance in the cathode circuit alters the cathode bias (effectively the grid bias) of the valves and, therefore, controls the gain or volume of the receiver.

It was also normal practice to connect the aerial to the unused end of the volume control. This gave a secondary control of the volume because as the resistance in the cathode circuit increased, the resistance between aerial and chassis decreased.



This 1936 model Radiola has two volume controls, one in the cathode circuit of the IF amplifier valve and the other in the audio section of the receiver. This arrangement is especially useful if the set is operated close to a powerful transmitter, since cutting back the gain ahead of the detector stage helps prevent overloading the audio stages.

Two volume controls

Some pre-war superhets actually had two volume controls. One control was, as previously explained, in the cathode circuit of the IF amplifier valve, while the other was in the audio section of the set.

Such an arrangement can be an advantage if the set is operated close to a powerful transmitter. Cutting back the gain ahead of the detector stage helps prevent overloading the audio stages. A local station switch has much the same effect but lacks variable control.

Superhet design moved away from these early ideas, with the advent of AVC, and the volume control was eventually placed in the control grid circuit of the first audio valve only. When this is the case, a cheaper car-

This is just part of the author's potentiometer collection. Many old pots require cleaning and lubrication before they can be put back into service. One certainly collects lots of parts in the vintage radio business!

A few hours work was all that was required to restore these old wirewound potentiometers. Many old radios from the 1920s and early 1930s used wirewound potentiometers as volume controls.

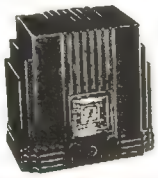
bon potentiometer is used.

The need for a wirewound volume control in those early superhets is because larger currents flow in cathode circuits than in control grid circuits.

However, in some instances, a carbon potentiometer can be used as a replacement for a wirewound type. If the volume control only alters the cathode bias on one valve, there is every chance of getting away with it. If it controls the bias on two valves, then a carbon pot may not be able to carry the current. Anything greater than a 0.25W load might be asking too much from a carbon potentiometer, although the larger old types were rated at one watt over the whole element. The wirewound pot was originally used for good reason.

Dick Smith Electronics and other electronics outlets sell nice new wirewound potentiometers, including 5kΩ and 10kΩ, types that are ideally suited to early superhets. There is, however, one disadvantage with these modern replacements: they seem to be only made with an extremely short splined shaft which is suitable for metric style control knobs only. That problem can be easily overcome, however.

Resurrection Radio



Vintage Wireless Specialists

Repairs - Restoration - Sales

Our skilled technicians offer QUALITY repairs and restoration.

We also have a large stock of Bakelite and Timber radios fully restored and for SALE.

Parts are available for the enthusiasts including over 900 valve types, high voltage capacitors, transformers, dial glasses, knobs, grille cloth etc.

Circuit diagrams for most Australian makes and models.

Send SAE for our catalogue.

WANTED - Valves, Radios, etc. purchased for CASH

Call in to our Showroom at:

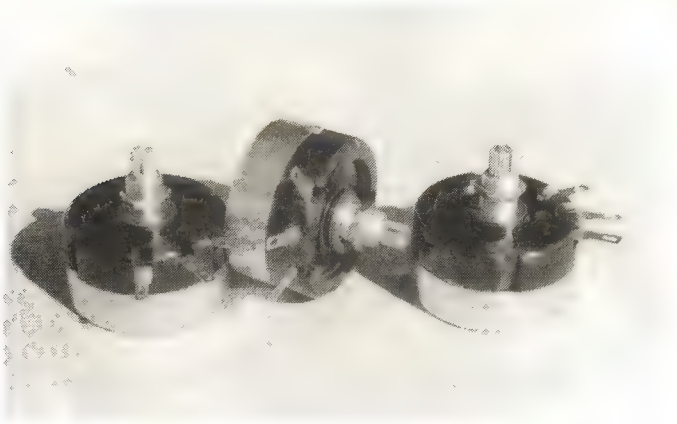
51 Chapel Street, Windsor,Vic 3181
PO Box 1116
Telephone: (03) 529 5639

Extension shaft

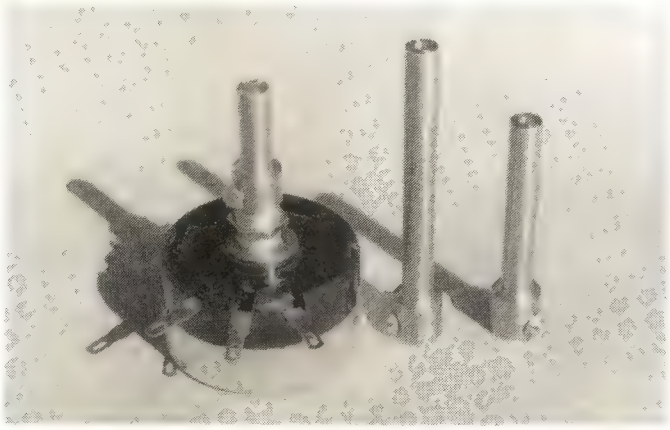
If these modern potentiometers are to be used for vintage radio applications, then they will require a neat-fitting extension shaft. Because I have a lathe in my workshop, tailor-made extensions are no problem. Without the lathe, difficulties could be encountered because the extension shaft needs to be a very close fit in order to maintain reasonable alignment of the shaft. An ordinary commercially made extension may not fit these extremely short shafted potentiometers.

When using modern wirewound potentiometers, remember that the wiper arm is insulated from the control shaft whereas in the older types this was not usually the case. This simply means that the arm is not automatically earthed when the pot is installed in the chassis by its securing nut. Therefore, the wiper arm connection may require earthing.

As I like to keep my vintage radios as original as possible, I prefer to use a similar potentiometer if there is a



Modern wirewound potentiometers usually have very short control shafts. A suitable extension will thus be required if you intend using this type of potentiometer as a replacement in a vintage radio.



Making up suitable extensions for wirewound pot shafts is a fairly straightforward job if you have access to a lathe. Alternatively, you may be able to find a suitable commercial shaft extender.

need to replace one. Hence the reason for reconditioning all those wirewound pots that had been put aside.

Many of these volume controls are quite reusable but they do require a particular maintenance routine if they are going to work smoothly again. In this case, the word "smoothly" has two meanings: smooth mechanically and smooth electrically.

Watch the needle

To see how rough some of these old pots are, one only has to connect an ohmmeter and watch the needle dance up and down the scale as the wiper arm is turned around. Dusty or corroded contacts will cause the meter needle to fluctuate, a fault that will result in considerable noise if the component is used as a volume control.

Worse still is the possibility that the fine resistance wire element has a break in it which will render the control pretty useless. A continuity check should be one of the first steps when repairing old wirewound potentiometers.

Checking the overall resistance often shows a variation in the specified resistance of up to 20%. For example, it is common for a 10kΩ pot to measure as low as 8kΩ or as high as 12kΩ when checked with an ohmmeter. Modern wirewound potentiometers are made more accurately - not that it really matters in a volume control.

Restoring old pots

Cleaning up an old wirewound pot can only be done properly if the whole unit is stripped first. The bearing part of the shaft needs to be thoroughly cleaned and regreased so that it will work smoothly. The electrical clean-up may require more time and effort.

If the wire element is in good condition, it can be cleaned with a toothbrush or a blast of compressed air. However, all too often, years of wear and tear have almost worn the wire through. Even those types of potentiometer where the wiper arm presses a metal disc onto the wire can be worn to almost breaking point. Pots that employ a direct contact wiper arm are even more likely to wear the wire through.

Now if the worn track is still in one piece, the potentiometer can usually be salvaged simply by removing the resistance winding and turning it over so that the opposite side of the coil is brought to bear on the wiper arm. This operation varies from being fairly easy to quite difficult, depending on the type of construction. Some types may not allow the wire element to be reversed.

Naturally, reasonable care needs to be taken when repairing potentiometers in the manner just described, for it can be a delicate task. In most instances, wirewound volume controls can be completely restored by reversing the resistance element and cleaning and relubricating the mechanicals. This treatment costs absolutely nothing whereas a new pot costs around $8 and requires an extension shaft.

The best part of an afternoon pased before I finished repairing my collection of wirewound potentiometers. Only two were discarded. It was a job that had been put off for quite some

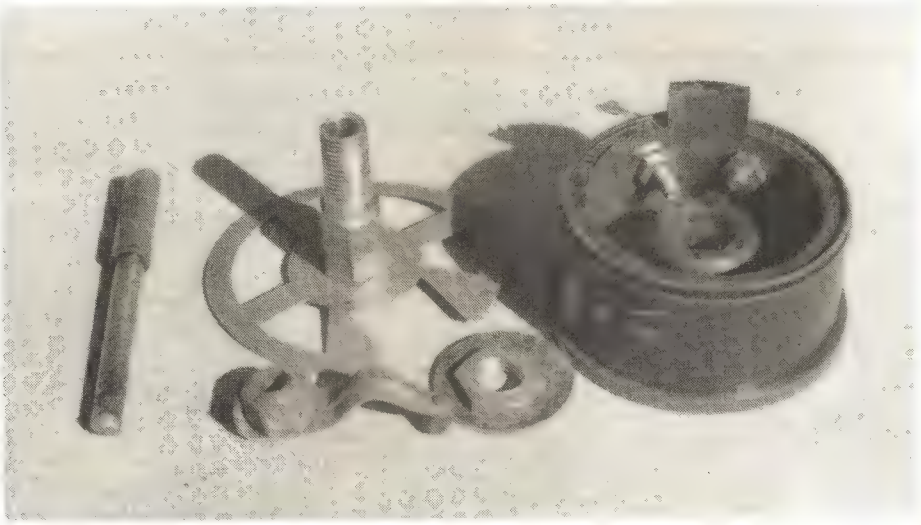
Background To Volume Control

The very early superhets used an autodyne type local oscillator/mixer. The circuit values in these were quite critical and so they could not be included in the volume control system.

With only one stage under control, overload on strong signals was a serious problem. The local/distant switch was the first solution but, because it relied on the user switching it in or out, was not always successful. Connecting the antenna to the unused end of the variable cathode resistor was a major improvement, provided the resistor value was carefully selected.

The development of the pentagrid converter was the next major step and allowed both valves to be controlled. Then, with the advent of AVC, the volume control was moved to the audio stage.

Some people did object to AVC in the early days. One reason for this was the increase in noise between stations, particularly on the very sensitive sets that were popular in those days. Another reason, probably arising out of the first one, was the belief that sets with AVC "picked up more static".



Depending on design and condition, many wirewound potentiometers can be restored by cleaning them and by reversing the wire resistance element so that a fresh section of track is brought to bear against the resistance arm.

time and now they were all ready to use. As a matter of fact, I could even think of where I could use one straight away.

Modifying an Airzone

One of my radio treasures is a 1937 5-valve console model Airzone. Although a 1937 model with octal based valves, it had a wirewound volume control in the cathode circuits of the first two valves. This control had developed a particularly bad spot where it made a lot of noise and the volume level jumped noticeably. It seemed like a good time to swap it over for one of my reconditioned units.

When removed, the pot was found to be in excellent condition and it was repaired and put back into service again instead of being replaced. The main problem with this particular potentiometer was a dob of gunk on the wiper track which effectively isolated a number of turns on the resistance element - hence the noise and the jump in volume.

However, this simple repair was about to lead onto a more ambitious project. While the set was on the workbench, it seemed like a good opportunity to look at other things.

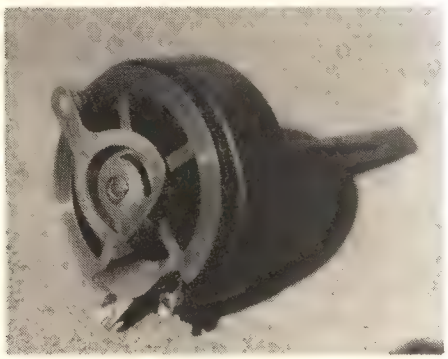
The old Airzone has no AGC (Automatic Gain Control; also known as AVC or Automatic Volume Control). It is one of those receivers which requires two hands to tune in order to avoid "crashes" on the stronger local stations. Automatic gain control was one of the really good innovations to come out of the early 1930s.

Why the Airzone was made without AGC is a bit of a mystery. Perhaps receivers without AGC were a little cheaper and the Airzone was a budget priced model? Perhaps some people liked them that way - who knows?

What I proposed to do was add AGC to the old Airzone. It is a good receiver with a very attractive timber cabinet and the addition of AGC would most certainly improve an already excellent radio. I had been thinking about such a conversion for quite a while and now seemed like the ideal time to do it, even if I had to remove the volume control that had only just been fitted.

A number of modifications would be necessary to convert the receiver to AGC. To begin with, the set would have to be changed to diode detection and the volume control shifted from the present cathode circuits and placed in the control grid circuit of the first audio valve. Finally, the AGC voltages would have to be connected to the control grids of the first two valves.

Unfortunately, we have run out of space, so the AGC story will have to wait for some other time. If the conversion turns out OK (and there is no reason why it shouldn't), I know what it will lead onto next. The old Airzone isn't the only set in my collection that would benefit from such a modification, so the operation will be repeated a number of times. **SC**



Many early pots had their working parts exposed to the dust and grime. Cleaning the resistance element and lubricating the mechanicals (particularly the wiper arm) often restores the unit to working condition again.

Vintage Service Tip

Checking Early Pickups

Old crystal & magnetic pickups can be quickly checked by connecting them to a set of high impedance headphones and then rubbing a finger across the needle or stylus. The scratching should be clearly heard in the headphones. The relative output can be checked by comparison with a known good unit.

Other then being open circuit, faults in early magnetic pickups are mainly confined to misalignment or drying out of the rubber armature dampers. In the latter case, repairs can be effected by using bicycle valve tubing. Cut off a length slightly less than that required and split it lengthwise. In most cases, the top (blade) rubber will also have hardened or disintegrated. Replacement of this is essential as it not only provides damping but also stops the armature hitting the magnet pole faces. This damper will have to be hand-shaped from sheet rubber of suitable resilience.

Watch out for shorts in the old shielded cable used in these pickups. This often has rubber compound insulation which also cracks & hardens.

Vintage Radio Service Tip is supplied by Resurrection Radio, 51 Chapel St, Windsor, Vic 3181. Phone (03) 529 5639.

RODIRVING ELECTRONICS

TEST US ON PRICE WITH THESE MULTI METER SPECIALS!

DIGITAL MULTI METER HC -4510
DISPLAY:4 1/2 DIGIT

BASIC ACCURACY: 0.5% DC V

DC VOLTAGE: 0-1000V
DC CURRENT: 0-10A
AC VOLTAGE: 0-750V
AC CURRENT: 0-10A
RESISTANCE: 0-20M OHMS
CONTINUITY TEST, DIODE TEST
DATA HOLD

SAVE $20

Q13030.....RRP ~~$149.95~~ NOW $129.95

DIGITAL MULTI METER HC-5010EC
DISPLAY: 3 1/2 DIGIT

BASIC ACCURACY: 0.5% DC

DC VOLTAGE: 0-1000V
DC CURRENT: 0-10A
AC VOLTAGE: 0-750V
AC CURRENT: 0-10A
RESISTANCE: 0-20M OHMS
CONTINUITY TEST, DIODE TEST

SAVE $20

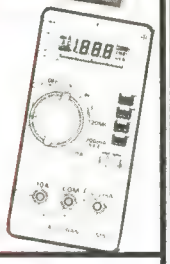
Q13010.....RRP ~~$119.95~~ NOW $109.95

DIGITAL MULTI METER HC-889
DISPLAY: 3 1/2 DIGIT

DC VOLTAGE: 0-1000V
DC CURRENT: 0-10A
AC VOLTAGE: 0-750V
RESISTANCE: 0-20M OHMS
CONTINUITY TEST, DIODE TEST,
DATA HOLD, TR HFE GAIN,
AUTO RANGE DMM WITH BAR GRAPH

SAVE $10

Q13040.....RRP ~~$99.95~~ NOW $89.95



DIGITAL MULTI METER HC-3500T
DISPLAY:3/12 DIGIT

BASIC ACCURACY: 0.5% DC

DC VOLTAGE: 0-1000V
DC CURRENT: 0-20A
AC VOLTAGE0-750V
AC CURRENT 0-20A
RESISTANCE: 0-20M OHMS
TEMPERATURE:-20C -1200C
CONTINUITY TEST, DIODE TEST
TEMPERATURE CAPACITANCE
FREQUENCY, hfe TEST, DATA HOLD.

SAVE $20

Q13000.....RRP ~~$169.95~~ NOW $149.95

ANALOGUE/DIGITAL MULTIMETER
HC-5050DB 3 1/2 DIGIT

BASIC ACCURACY: 0.5% DC

DC VOLTAGE: 0-1000V
DC CURRENT: 0-10A
AC VOLTAGE: 0-750V
AC CURRENT: 0-10A
RESISTANCE: 0-20M OHMS
DC AC RMS:-45dB -+50dB
TEMPERATURE: -20C-1200C
AC FREQ SPREAD: 50Hz-2KHz
CONTINUITY TEST, DIODE TEST

SAVE $20

Q13020.....RRP ~~$169.95~~ NOW $149.95

LOGIC PROBE (LP-2800)
USEFUL FOR TTL AND CMOS.
HIGH & LOW INDICATORS
PULSE MEMORY.
FOR THE HOBBIEST OR SERIOUS TECHNIICIAN
FOR TRACING THOSE HARD TO FIND FAULTS
ON LOGIC BOARDS.

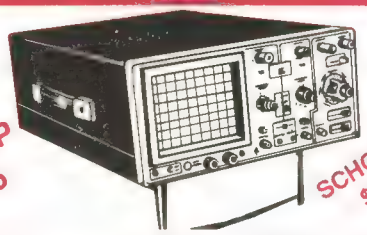
SAVE $10

Q11272.....RRP~~$29.95~~ NOW $19.95

BACK TO SCHOOL SPECIALS ON OSCILLOSCOPES!

SAVE $55

SCOOP $695



SCHOOLS TAKE NOTE $595 Tax exempt.

20 MHz DUAL TRACE OSCILLOSCOPE

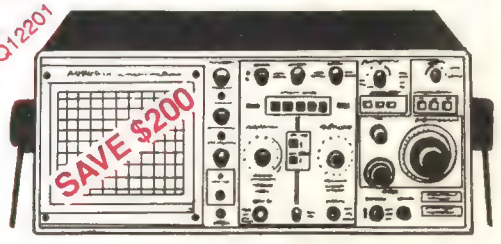
CTR DISPLAY: • 150 mm rectangular
VERTIACAL DEFLECTION:
• Deflection Factor: 5mV to 20V / Div on 12 ranges in 1-2-5 step with fine control
• Bandwidth DC: DC to 20 MHz (-3dB) AC: 10Hz to 20 MHz (-3dB)
• Operating modes CH-A, CH-B, DUAL and ADD (ALT/CHOP L202 only)
• Chop Frequency: 200 KHz Approx.
• Channel separation: Better than 60dB at 1KHz
TIME BASE
• Type: Automatic & normal triggered in automatic mode, sweep is obtained without input signal
• Sweep Time: 0.2m Sec to 0.5 Sec/ Div on ranges in 1-2-5 step with fine control and X-Y.
• Magnifier: X5 at all times.
TRIGGERING
• Sensitivity Int: 1 Div or more Ext: 1Vp-p or more.
• Source: INT, CH-B, LINE or EXT
• Triggering Level: Positive and Negetive, continuously variable level; Pull for Auto.
• Sync: AC, HF Rej, TV (each + or-) at TV Sync. TV-H (line) and (frame) sync are switched automatically by SWEEP TIME/Div switch.
HORIZONTAL DEFLECTION
• Deflection factor: 5mV to 20V/ Div on 12 ranges in 1-2-5 step with fine control
• Frequency response: DC to MHz (-3dB)
• Max Input Voltage: 300V DC + AC Peak of 600V p-p
• X-Y operation: X-Y mode is selected by SWEEP TIME/ Div switch.
• Intensity Modulation Z Axis: TTL Level (3Vp-p-50V) + bright, - dark
OTHER SPECS: • Weight: 7Kg Approx • Dimensions: 162 (H) x 294(W) x 352(D)mm.

CRO Probe to suit
$39.50 each - Cat. Q12201

Q12105.....RRP ~~$750~~ NOW $695.

CRO Probe to suit
$39.50 each - Cat. Q12201

SAVE $200



100 MHz 3 CHANNEL 8 TRACE MODEL 5510

This instrument meets the customers needs in quality of performance, efficiency, function, design, and cost! Being rugged, highly reliable and a multi-purpose 3 - channel, 8 trace oscilloscope with a 6 inch domed mesh type 14kV post deflection acceleration cathode-ray tube and with a fine red internal graticule.
FEATURES:
• Compactness, lightweight, ruggedness and simple design.
• The diecast frame provides compactness lightweight and ruggedness .
• Easy Operation
Light torque lever switches and pushbutton switches are used.
• High Brightness CTR, high acceleration voltage and high beam efficiency of the 150mm rectangular CTR ensures a bright high speedsweep observation
• Multi mode display system
CH1, CH2, CH3, Add any combination or all the channels may be viewed simultaniously. Maximum 8 trace displaying is possible with the ALT sweep function.
• High sensitivity and wide frequency bandwidth.
The maximum vertical sensitivity is 1mV/DIV (when x 5 MAG)at 20 MHz or greater 3dB and mV/DIV at 100 MHz or greater -3dB.
• High input impendance
The input impendance of CH1, CH2, CH3, is 1MΩ†2%, 25pF †3pF

Q12109.....RRP $2995.00 NOW $2795.00

SCHOOLS & COLLEGES TAKE NOTE! ONLY $2395 tax exempt.

008 335757 TOLL FREE MAIL ORDER HOTLINE FOR CREDIT CARD ORDERS!

FREE 148 PAGE ELECTRONICS CATALOGUE WITH 32 PAGES OF DATA FREE WITH EVERY ORDER OVER $100

AUSTRALIA'S CHEAPEST DISK PRICES

ROD IRVING ELECTRONICS

ALL PRICES PER PKT/BOX OF TEN

MEMOREX DISKS

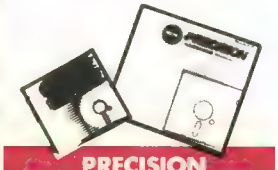
	1-9 Boxes	10+		1-9 Boxes	10+
3 1/2"DD	$19.95	$18.95	5 1/4"DD	$14.95	$12.95
3 1/2"HD	$45.95	$42.95	5 1/4"HD	$23.95	$22.95

VERBATIM DATALIFE

	1-9 Boxes	10+
3 1/2"DD	$28.50	$27.95
3 1/2"HD	$53.50	$52.50
5 1/4"DD	$22.95	$21.95
5 1/4"HD	$24.95	$23.95

VERBATIM VALUELIFE

	1-9 Boxes	10+
3 1/2" DD	$23.95	$22.95
3 1/2" HD	$39.95	$37.95
5 1/4" DD	$12.95	$11.95
5 1/4" HD	$19.95	$18.95



PRECISION

	1-9 Boxes	10+
3 1/2"DD	$19.95	$18.95
3 1/2"HD	$39.95	$37.95
5 1/4"DD	$9.95	$8.95
5 1/4"HD	$19.95	$17.95

TDK

	1-9 Boxes	10+
3 1/2"DD	$39.95	$37.95
3 1/2"HD	$69.95	$67.95
5 1/4"DD	$19.95	$18.95
5 1/4"HD	$39.95	$37.95

DYSAN

	1-9 Boxes	10+
3 1/2"DD	$22.95	$21.95
3 1/2"HD	$39.95	$37.95
5 1/4"DD	$19.95	$18.95
5 1/4"HD	$31.95	$29.95

XIDEX

	1-9 Boxes	10+
3 1/2"DD	$29.95	$27.95
3 1/2"HD	$49.95	$47.95
5 1/4"DD	$19.95	$17.95
5 1/4"HD	$29.95	$27.95

SAVE ON "NO BRAND"

FREE DELIVERY OVER $100

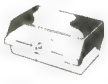
BOXES OF 10 DISKS
LIFETIME WARRANTY

	1-9	10+	50+	100+	500+
5 1/4"DS/DD	$4.95	$4.80	$4.70	$4.60	$4.40
5 1/4"DS/HD	$10.50	$10.25	$10.00	$9.50	$8.90
3 1/2"DS/DD	$9.75	$9.50	$9.25	$9.00	$8.50
3 1/2"DS/HD	$19.50	$18.95	$18.50	$18.00	$17.50

DISK STORAGE BOXES

100 x 5 1/4" ECLIPSE
C16042.....$11.95

40 x 3 1/2" ECLIPSE
C16040.....$8.99



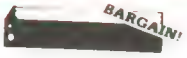
120 x 3 1/2" LOCKABLE
C16039.....$21.95

100 x 5 1/4" LOCKABLE
C16020.....$13.95

50 x 5 1/4" LOCKABLE
C16025.....$11.95

120 x 5 1/4" LOCKABLE
C16028.....$19.95

RIBBONS



PRINTER RIBBONS TO SUIT:

- CP80, SX80, DP80, BX100 BX100, MB100

	1-9	10+
C22036..	$19.95	$17.95

- MX80, FX80, RX80, FX800 MX70, MX80, LX800

	1-9	10+
C22031....	$16.95	$15.25

- MX100, FX100, RX100,LQ1000

	1-9	10+
C22002....	$19.95	$17.95

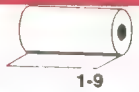
- LX80

	1-9	10+
C22003..	$12.95	$11.95

- C ITOH 8510-1550

	1-9	10+
C22051..	$13.95	$12.50

FAX ROLLS



	1-9	10+
C20092	$8.95	$8.50

SIZE: 210mm x 11.5mm x 30 M

	1-9	10+
C20094	$9.95	$9.50

SIZE: 210mm x 24.5mm x 50 M

	1-9	10+
C20096	$17.95	$16.95

SIZE: 210mm x 25.4mm x 100 M

	1-9	10+
C20098	$9.95	$9.50

SIZE: 216mm x 25.4mm x 30 M

	1-9	10+
C20100	$11.95	$11.50

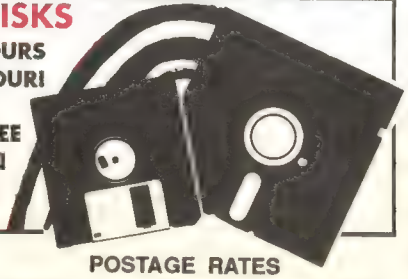
SIZE: 216mm x 25.4mm x 50 M

	1-9	10+
C20102	$8.95	$8.50

SIZE: 210 mm x 25.4mm x 30 M

RAINBOW DISKS

5 DIFFERENT COLOURS
OR 1 SINGLE COLOUR!
10 DS/DD
COMES WITH A FREE
PLASTIC DISK BOX!
ONLY $9.99

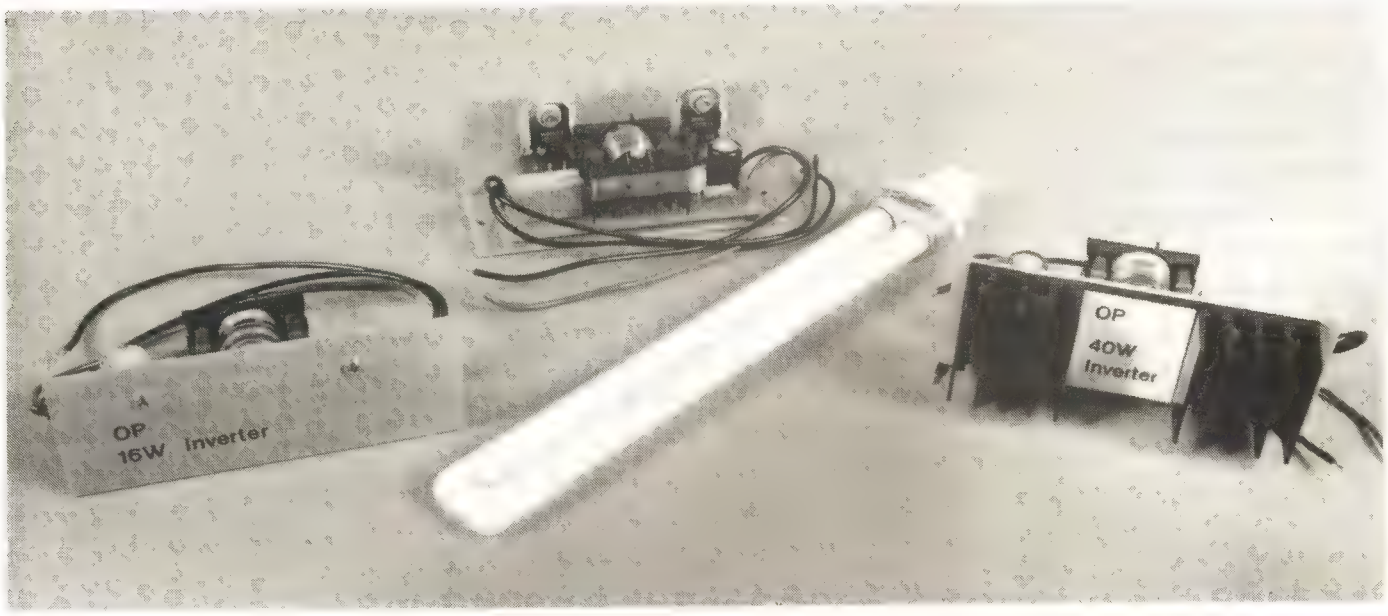


POSTAGE RATES

$1 - $9.99.....$3.00	$100 - $199.....$7.00
$10 - 24.00.....$3.50	$200 - $500.....FREE
$25 - $49.99.....$4.50	$500 Plus.....FREE
$50 - $99.99.....$6.00	

CITY: 48 A'BECKETT ST, MELBOURNE	PH: (03) 663 6151	FAX: (03) 639 1641
NORTHCOTE: 425 HIGH ST, NORTHCOTE	PH: (03) 489 8866	FAX: AS PHONE.
SYDNEY: 74 PARRAMATTA RD, STANMORE	PH: (02) 519 3134	FAX: (02) 519 3868
MAIL ORDER: 56 RENVER RD, CLAYTON	PH: (03) 543 7877	FAX: (03) 543 2648

008 335757 TOLL FREE MAIL ORDER HOTLINE FOR CREDIT CARD ORDERS!



Three inverters for fluorescent lights

Battery powered fluorescent lamps are commonly available as a feature of some torches but they are flea-power units. Here we present three DC-AC inverters, suitable for fluorescent lights rated up to 40 watts.

Design by OTTO PRIBOJ

Fluorescent tubes are one of the most efficient forms of electric lighting but because of their high voltage requirements, they are rarely used unless 240VAC mains power is available.

Yet there are many applications where the high efficiency of fluorescent tubes could be highly useful. These range from portable emergency lighting to lighting for recreational vehicles, caravans, boats and farms. In fact, if a pinpoint light source or a concentrated beam is not required, then fluorescent lighting should be the first choice, because of its efficiency, glare-free light and freedom from shadows.

This series of three inverters provide the necessary high AC voltage to drive a fluorescent tube from a 12V DC supply and at a high efficiency. Not only that, the circuits are low profile and use readily available components.

DC to AC inverters intended for driving fluorescent tubes have two quite different requirements. First, they must generate sufficient voltage to fire the tube. Once the discharge is established through the tube, it becomes a negative resistance which means that unless there is some means of current limiting, the tube will destroy itself.

In conventional mains powered fluorescent lamp fittings, the ballast performs two duties. First, in conjunction with the starter bulb, it produces the voltage to fire the tube and then, its inductive reactance limits the current through the tube to a safe level. This is a very effective and time proven circuit which is used in billions of fluorescent lamp fittings throughout the world.

But using a ballast to limit the lamp current in a battery-powered fluorescent circuit is not practical because of the relatively high losses involved (about 10 watts for a 40 watt tube). This is too much to tolerate for a battery operated circuit.

Fortunately, as the saying goes,

"there is more than one way of skinning a cat". When designing a transistor driven inverter, it is desirable to make it run at a high frequency. This enables a very compact ferrite cored transformer to be used and also allows losses to be minimised.

Using a high frequency to drive the fluorescent light fitting then gives a further advantage - we don't have to use a conventional inductive ballast. Instead, we can use a capacitor. This will limit the current but the capacitor will have very low internal losses which translates to higher efficiency. As well, the capacitor will be more compact and cheaper than an inductive ballast.

It is also possible to design the inverter to have a higher internal impedance in order to limit the discharge current through the fluorescent tube but that tends to lead to higher losses and hence, higher current drain.

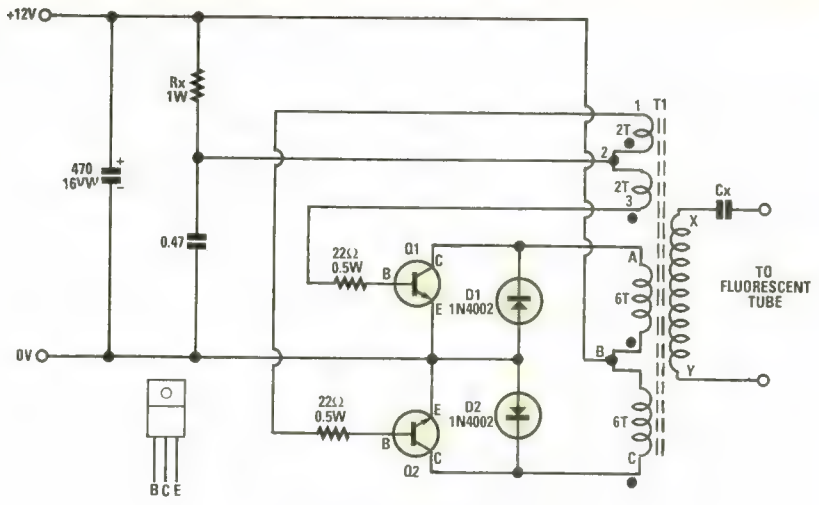
Let's now have a look at the circuit.

The circuit

Simplicity is the byword for this circuit although as with many ostensibly simple circuits, there is more to it than at first meets the eye. As shown in Fig.1, the circuit is essentially a straightforward push-pull transistor inverter. The positive DC supply connects to the centre-tap connection on the primary winding of the transformer and the collectors of the two power transistors are each connected to the ends of the primary winding.

When one transistor, say Q1, turns on, it saturates and applies the full 12V DC across half the transformer primary winding. By transformer action, this applies 12V (in opposite polarity) to the other half of the transformer winding, so that we have a total of 24V across the full winding. The current builds up in the transformer winding associated with Q1 until it reaches its maximum value whereupon Q1 is suddenly forced to turn off and Q2 turns on.

Why? Because transformer action also applies to the other windings of the transformer and this means that the base drive voltages for Q1 and Q2 are generated by the associated 2-turn windings. When the current pulled by Q1 reaches its maximum value, it effectively becomes DC and since transformers don't work on DC, the base drive voltage to Q1 suddenly drops to zero.



	RX	Cx	Q1 Q2
40W	120Ω + 22Ω	.001 600VAC/.001 600VAC	TIP3055
20W	330Ω	.001 600VAC/ .001 600VAC	TIP3055
7-16W	680Ω	.001 600VAC	MJE3055

VERSATILE FLUORESCENT INVERTER

Fig.1: the circuit is a straightforward transistor inverter which steps up the 12V DC battery voltage to about 1000V AC to fire the fluorescent tube. Capacitor Cx limits the tube current to a safe value while flyback diodes D1 & D2 protect the transistors from voltage spikes when each one turns off.

This causes Q1 to turn off and since the current pulled by Q1 is no longer DC but rapidly dropping to zero, transformer action now generates base voltage for Q2 which then turns on fully. This reverses the 24V across the full primary winding and so the current pulled by Q2 climbs to its maximum value whereupon the cycle begins again.

The voltage across the transformer primary is 24 volts peak or approximately 12 volts RMS. (Actually, it will usually be higher than that, depending on the condition of the battery). This voltage is then stepped up by the 500-turn secondary winding to around 1000 volts RMS. This is enough to fire any fluorescent tube currently available. It will even fire the 1.5-metre long 58 watt tubes.

Once the discharge current through the tube is established, capacitor Cx in series with the tube limits the current to a safe value.

Starting the inverter

Balanced inverters such as the one depicted in the circuit of Fig.1 will usually not start by themselves. They need a fixed bias so that one of the transistors can turn on and start the switching cycle described above. This bias is provided by resistor Rx and the 22Ω 0.5W resistors in series with the bases of Q1 and Q2. When power is first applied, both transistors try to turn on but the one with the highest current gain (beta) wins the race and starts the cycle.

Diodes D1 and D2 are flyback protection diodes, included to protect the transistors from the peak voltages that are developed when each one turns off.

Air gap in ferrite core

All three versions use the same transformer but the gap between the ferrite cores is varied to set the current drain. This concept may be novel to some of our readers so we'll explain the principle. Normally the transformer used for DC-AC inverters is constructed without any gap which means that the core permeability is very high. This means that a relatively small magnetising force (ie, ampere-turns) is required to saturate the core. This results in a square hysteresis curve and a very square AC waveform in the primary and secondary windings.

Such a waveform though is not really suitable if the current limiting element for the fluorescent tube is to be a capacitor - all it will let through will be very narrow current spikes

which will not let the tube operate at normal brilliance.

No, for the capacitor to correctly limit the current through the tube, the voltage waveform from the transformer should be more rounded, like a sinewave. This is achieved by having an air gap between the two halves of the ferrite transformer core.

The oscilloscope photo accompanying this article shows the voltage waveforms which can be expected from the transformer. Note that they are nothing like square waves but much more like sinewaves.

Having an air gap means that the inverter also draws a substantially higher current and that means the exact dimension of the air gap is quite important. We'll have more to say about this later.

Construction

All three inverters can be built using the same PC board which is coded SC11103901 and measures 95 x 40mm.

When you buy or make the board and before you commence construction, check it for breaks or shorts in the tracks. If there are any, correct them now.

The table in Fig.1 shows the values for Rx and Cx for each model of the inverter. It also indicates that TIP3055s are used for the smallest inverter while the more rugged MJE3055s are used for the 20 watt and 40 watt models.

After checking the board, you can install the wire link, the resistors, diodes and the capacitors. Make sure that you have the electrolytic capacitor inserted correctly.

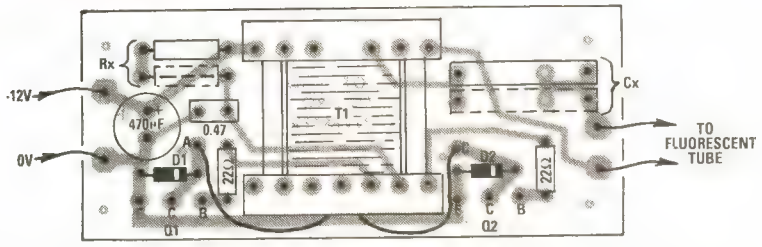


Fig.2: all three versions of the inverter are built on the same PC board but some of the component values are different, as are the transformer winding details (see Fig.1). The completed board is mounted on an L-shaped bracket which is used for heatsinking but note that Q1 & Q2 must be electrically isolated from this heatsink as shown in Fig.4.

PARTS LIST

16W Version

1 PC board, code SC11103901, 99 x 45mm
1 L-shaped mounting bracket (110mm in length)
1 TO-220 heatsink mounting kit
1 Siemens ETD29 transformer bobbin, N27 core & clips
1 25-metre length 0.2mm ECW
1 5-metre length 0.25mm ECW

Semiconductors

2 MJE3055 NPN power transistors
2 1N4002 200V 1A power diodes

Capacitors

1 470µF 16VW PC electrolytic
1 0.47µF 63VW metallised polyester (WIMA MKS, 5mm lead spacing)
1 1000pF 600VAC polypropylene (WIMA FKP 1)

Resistors (5%)

1 680Ω 1W
2 22Ω 0.5W

Miscellaneous

Hookup wire, screws, nuts, washers, solder, etc

Note: ECW = enamelled copper wire

Winding the transformer

Before you continue any further with the board, you should begin winding the transformer. Fig.3 shows where the windings should be terminated on the former, as well as giving the correct number of turns for each inverter.

Begin by winding on 100 turns of 0.2mm enamelled copper wire (or 0.25mm for the 40 watt inverter). This should get you from one side of the core to the other. Now, using a small brush, apply an even coating of petroleum jelly (Vaseline) to the winding.

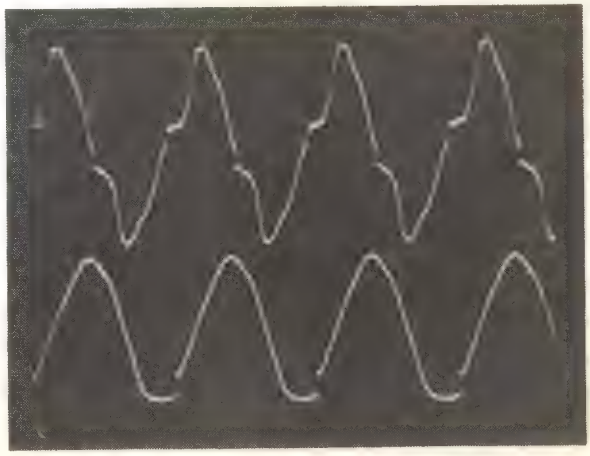
Once this has been applied, cover the winding with a layer or two of polypropylene foil. A good source of this is those freezer bags you can buy from your local supermarket. (These bags are crinkly and noisy when you rattle or crumple them them).

You can now begin winding the second layer of another 100 turns, after which you repeat the above process. Continue doing this until you have wound five layers of 100 turns, making up the 500 turns of the secondary winding. Note that if you are building the 16W version, only 400 turns are required.

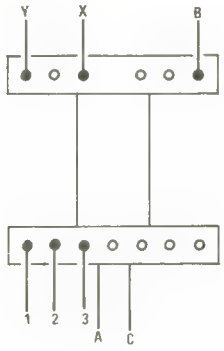
Once you've completed the last of the five windings, wind on five to six layers of polypropylene foil to ensure isolation.

Now for the primary and base windings. The primary winding (that is the winding to the transistor collectors) contains two windings of six turns which are tapped in the middle. The gauge of the wire in this case depends on the inverter you are working on. For the 7-16W version, the wire is 0.35mm and 0.5mm for the other versions.

The base windings are two wind-



This oscilloscope photograph shows the voltage waveforms that can be expected from the transformer. At top is the 200V p-p tube voltage while the bottom trace shows the 30V p-p waveform which appears on the transistor collectors. The frequency is 17kHz (approx).



	1-2,2-3	A-B,B-C	X-Y
40W	2T, 0.35mm ECW	6T, 0.5mm ECW	500T, 0.25mm ECW
20W	2T, 0.35mm ECW	6T, 0.5mm ECW	500T, 0.2mm ECW
7-16W	2T, 0.35mm ECW	6T, 0.35mm ECW	400T, 0.2mm ECW

Fig.3: terminate the transformer windings exactly as shown here. The step-by-step winding details are given in the text. Be sure to use the correct gauge of wire & number of turns on the secondary for each version.

ings of two turns each, again tapped in the middle. The wire gauge here is 0.35mm throughout.

Note that some inverter transformers have the primary windings wound bifilar (ie, with two wires together) but in this case bifilar winding has not been used.

When all the windings are complete, the starts and finishes must be cleaned of enamel, tinned and then terminated to the various pins of the bobbin. Before the wires are terminated, it is a good idea to fit some sleeving over them.

Setting the air gap

With the windings completed and terminated, the two ferrite half-cores can be placed into the bobbin and held in place by the spring clips. Before the second core half is placed though, the air gap needs to be set. Actually, it is not an air gap but a space between the two core halves, set by a given thickness of insulating material which may be paper or plastic.

For the 7-16W inverter, the gap is 0.1mm; for the 20W and 40W models, 0.44mm. How do you obtain a suitable thickness of material for that gap? If you have vernier caliper or micrometer, then it is simply a matter of measuring some plastic sheeting or paper and then folding it to give the right thickness.

If you don't have one of these instruments, a single thickness of a page

PARTS LIST

20W Version

1 PC board, code SC11103901, 99 x 45mm
1 SOT-93 transistor heatsink mounting kit
1 L-shaped mounting bracket (110mm in length)
1 Siemens ETD29 transformer bobbin, N27 core & clips
1 30-metre length 0.2mm ECW
1 1-metre length 0.5mm ECW
1 1-metre length 0.35mm ECW

Semiconductors

2 TIP3055 NPN transistors
2 1N4002 200V 1A diodes

Capacitors

1 470µF 16VW PC electrolytic
1 0.47µF 63VW metallised polyester (WIMA MKS, 5mm lead spacing)
2 1000pF 600VAC polypropylene (WIMA FKP 1)

Resistors (5%)

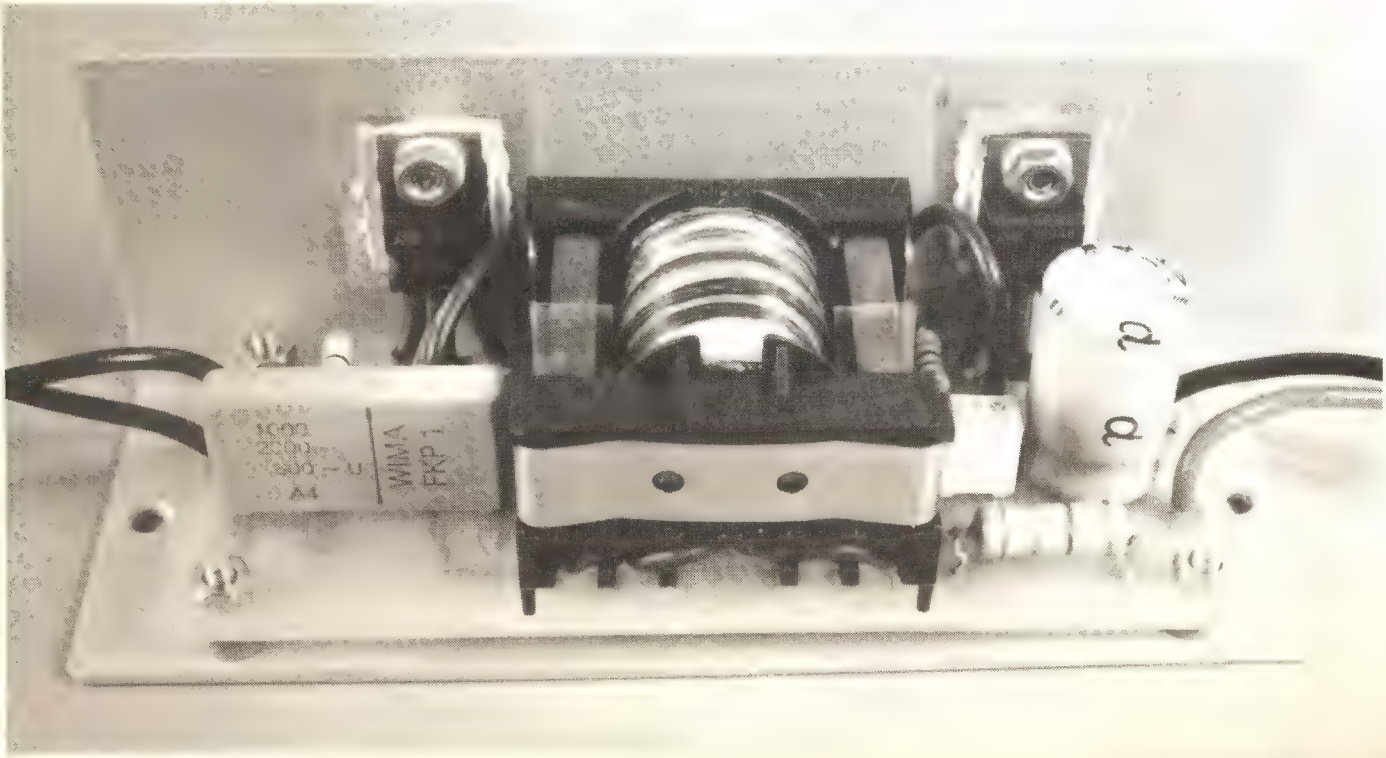
1 330Ω 1W
2 22Ω 0.5W

Miscellaneous

Hookup wire, screws, nuts, washers, etc

Note: ECW = enamelled copper wire

Below: the switching transistors are bolted to the L-shaped bracket to ensure adequate cooling. This is the 16W version which uses MJE3055 transistors.



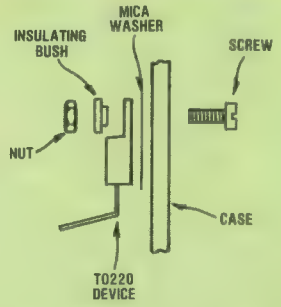


Fig.4: mounting details for the switching transistors. Smear all mating surfaces with heatsink compound before bolting each transistor to the heatsink, then use your multimeter to confirm that its metal tab is correctly isolated.

of this magazine is close to .05mm. A single page of a newspaper is close to .08mm while standard 80gsm photocopier paper is 0.1mm. With a combination of these materials, you can obtain the right thickness of material for the transformer gap.

By the way, you can obtain a very cheap plastic set of vernier calipers for as little as $3.50. See your local hardware store.

Now that you've completed the transformer, you can insert it into place on the PC board. Use the overlay diagram to make sure you have connected it up correctly. Check again for any solder splashes on the board as it will not be possible to do this after the two transistors have been mounted on the heatsink.

Heatsink bracket

As you can see from the photos, the prototypes had the two transistors mounted on an L-shaped aluminium bracket. The two transistors are insulated from the aluminium bracket with mica washers, insulating bushes and heatsink compound, as shown in Fig.4.

The L-shaped bracket also has the PC board mounted on it, as you can see. Before you mount the transistors on the bracket, solder them into position on the board; then, using four mounting screws, spacers and nuts, secure the board to the bracket.

Note that the 40W version of the inverter needs an additional finned heatsink mounted to the back of the aluminium bracket. Use a larger heatsink than the one shown in our photos, as our prototype ran a little too hot for our liking.

When the transistors are mounted, switch your multimeter to the ohms range and make sure that both transistors are correctly isolated from the aluminium bracket. You should get an open circuit if you measure between the bracket and the transistor tabs.

Ideally, the whole board and bracket assembly should be mounted inside a standard fluorescent light fitting but before you do that, it's time to check the circuit operation. You will need a 12V power supply or battery capable of delivering sufficient current to suit the inverter model. When operating correctly, the inverters will draw the following currents:

7-16W	0.9A
20W	1.4A
40W	3.2A

When connecting the power supply to the inverter, make absolutely sure you have the correct supply polarity. If you don't, you are liable to damage the transistors.

When you are connecting the fluorescent tube, you will find that it has two pins at each end. These pins are for the heater filaments which are not used in this circuit. You can make the connection at each end to either filament pin - it does not matter which.

When power is applied, the tube should immediately light up and then abruptly increase its brilliance after about one or two seconds. There is no flickering as with conventional starter/ballast fluorescent lights.

Note that fluorescent tubes do not reach their full brilliance when they are first turned on. Depending on the ambient temperature, they make take 10 minutes or longer to reach full brilliance.

Even so, if you are a making a di-

PARTS LIST

40W Version
1 PC board, code SC11103901, 99 x 45mm
1 SOT-93 transistor heatsink mounting kit
1 L-shaped mounting bracket (110mm in length)
1 single sided finned heatsink (see text)
1 Siemens ETD29 transformer bobbin, N27 core & clips
1 30-metre length 0.25mm ECW
1 1-metre length 0.5mm ECW
1 1-metre length 0.35mm ECW

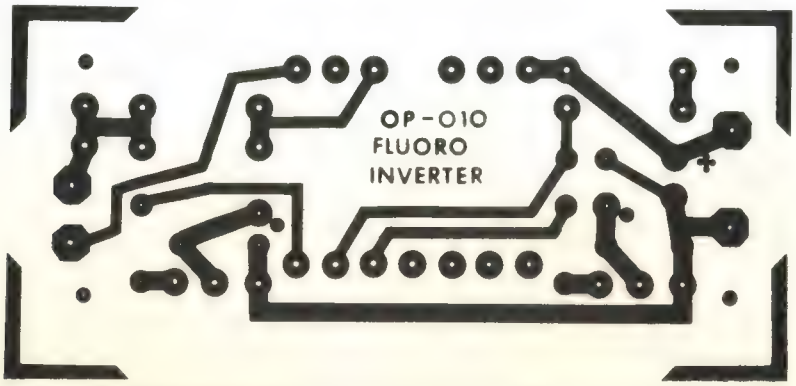
Semiconductors
2 TIP3055 NPN transistors
2 1N4002 200V 1A diodes

Capacitors
1 470µF 16VW PC electrolytic
1 0.47µF 63VW metallised polyester (WIMA MKS, 5mm spacing)
2 1000pF 600VAC polypropylene (WIMA FKP 1)

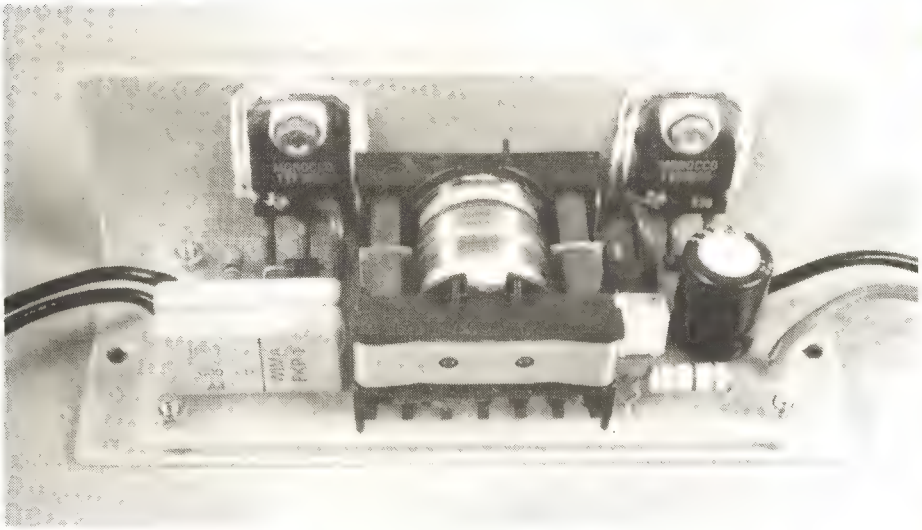
Resistors (5%)
1 120Ω 1W
1 22Ω 1W
2 22Ω 0.5W

Miscellaneous
Hookup wire, washers, screws, nuts, solder, etc.

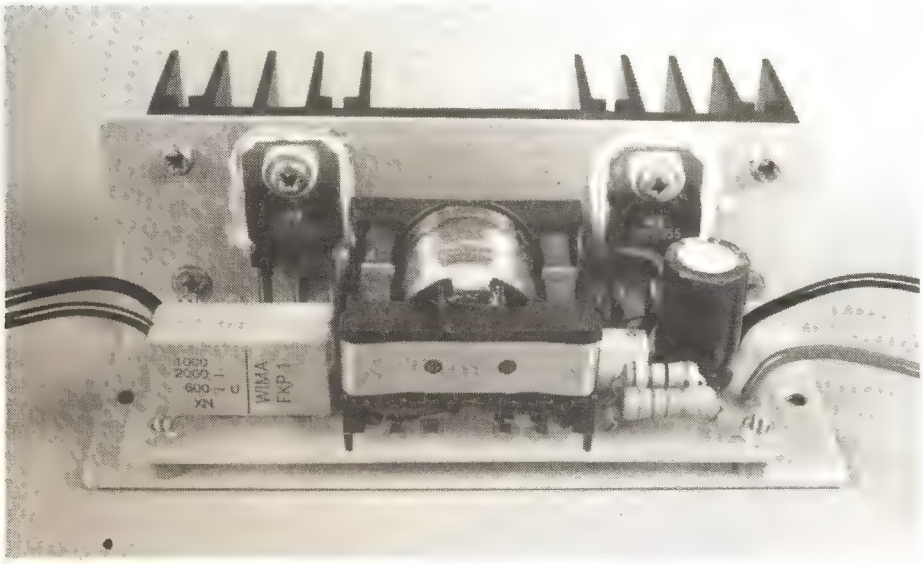
Note: ECW = enamelled copper wire



You can use this full-size pattern to etch your own PC board and to check your finished board for possible defects.



This view shows the 20W version of the inverter. Note the mica washers & insulating bushes used to isolate the switching transistors from the L-shaped aluminium bracket (see also Fig.4). The completed converter should be compact enough to mount in a standard fluorescent light fitting.



A large finned heatsink (preferably slightly larger than the one shown here) should be fitted to the 40W version to stop the switching transistors from overheating. Although rated for driving 40W tubes, this version can also be used with the 36W slimline tubes, while the 20W version above can be used with 18W slimline tubes.

rect comparison between a fluorescent tube powered by one of these inverters and an identical tube powered from a conventional mains fitting, you will find the brilliance of the inverter-powered tube slightly down. This is normal and is the compromise we came to for best efficiency.

If you find that your inverter-powered lamp is not as bright as it should be and the inverter is drawing less current than it should be, it is likely that the transformer gap is not correct. Increasing the air gap by adding another thickness of paper should increase the brightness and the current drain. However, the current drain should not be appreciably higher than the values we show above, otherwise the inverter transistors will rapidly overheat.

When normal operation is confirmed, you can mount the inverter inside a standard fluorescent light fitting and the job is finished. Finally, you can use the newer slimline tubes with these inverters. The 20W inverter will happily drive an 18W slimline tube while the 40W job will drive a 36W slimline tube. SC

BARGAIN PRICED LASER

A special purchase of this tube, which is priced at a fraction of its real value allows us to offer this mains (240v) powered KIT SPECIAL. Use it for disco effects, holography, experimenting, etc, etc.

Includes a large 2-3mW HE-NE tube, transformer, PCB, and all components, amins plug and lead plus the mains switch: Everything except the case.
IMPORTANT: This product carries lethal voltages and is not for kids.

Strictly during February and March, or until stocks run out at this unrepeatable price of:

ONLY $249.90 !! The price even includes Certified P&P. Don't tell your friends because you could miss out yourself!

LASER SCANNER DRIVER KIT

This PCB and all components kit can be driven using an audio source or an electret microphone, to produce magnificent visual displays which are synchronised to music.

Drives speakers with mirrors attached, or professional X-Y scanner. Makes provision possible driving from a computer (with correct software). The kit includes the PCB, all onboard components, battery holde, external potentiometer, and even an electret microphone for

ONLY $20.00
Professional X-Y scanner: $220
Small front surfaced aluminium mirrors: $9.00ea
(These are to attach to the front of speakers)

SEE IN THE DARK!

with our INFRA RED NIGHT VIEWER at a SPECIAL price of ONLY $349.00

Only while stocks last, and during March and April only we will include a high quality round IR filter which is 3mm thick and has a diameter of 75mm. Can be easily cut down to suit your torch

We have good stock of the 6032A tubes. This is your opportunity to build your own night viewer. A product which commercially usually costs 1000's of dollars at a fraction of the price. We supply the electronic kit, a 6032A Image Intensifier tube, and the case components.

The 6032A tubes are BRAND NEW and perform well with a good infra red torch. Torch and Lenses are not supplied

VISA MasterCard Bankcard

OATLEY ELECTRONICS
PO BOX 89, OATLEY, NSW 2223
Telephone: (02) 579 4985
Fax No: (02) 570 7910
Certified p&p $4-$6 Aust. NZ add $2
Melbourne Distributor - Electronics World
(03) 723 3860 or (03) 723 3094

PHONEORDER TOLL FREE ALTRONICS 008 999 007

ALTRONICS

1991 ELECTRONICS COMPONENTS CATALOGUE

YOURS FREE with this month's Silicon Chip and Electronics Australia Magazines

OR Send $1 to cover P&P to: ALTRONICS MAIL ORDER, PO Box 8350, Perth Stirling Street, Perth WA 6849

Jack O'Donnell
Managing Director

Our 1991 Catalogue has even more fantastic new products and greater value than last year's. And we still offer the technical help that only a staff of electronics enthusiasts like yourself is able to give. Of course, in addition to this we have our **FAMOUS OVERNIGHT DELIVERY** Australia wide and Bankcard phone order service to 6pm Monday to Friday. All on our quality products at **DIRECT IMPORT PRICES** that enables **YOU TO SAVE UP TO 50%** off competitors' prices.

JUST TO SHOW YOU THAT WE MEAN BUSINESS

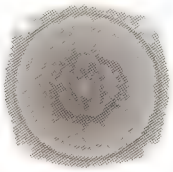
We have all these great products illustrated here at never to be repeated prices. But be quick, these prices are for current stocks only — definitely no backorders at these rates.

SPEAKER CLEARANCE

We have huge quantities which we must clear out this month.

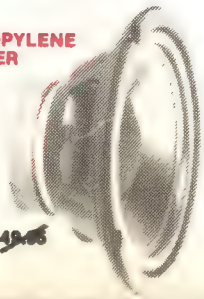
MINI SPEAKER
3¼"
8 Ohm 3 watt
C 0612 JUST $4
10 UP $3

125mm (5")
Dual Z 4/8 Ohm 3 Watt RMS.
C 0618 $6
10 UP $5



125mm (5") 15 Watt
High efficiency dual cone quality driver. Excellent midrange "presence". Roll edge cone suspension. Used with the Redford weatherproof sound column range. Ideal Hi Fi Extension Speaker.
C 0632 16 Ohm ~~$19.80~~
NOW $10
$19 PER PAIR

POLYPROPYLENE 8" WOOFER



C 3060 ~~$49.95~~
$40

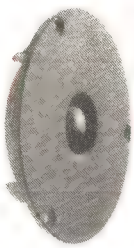
FERRO FLUID DOME TWEETER
100mm 60 Watts
C 3012 Normally $29.50 each
Now
$15.00
SAVE $14.50
BUY FOUR FOR $50.00
From less than half price!

PLASMA LAMP DISPLAY
Supplied complete with AC Mains Adaptor
A 0210
Normally $199
Save $50
only $149
be quick

TELEPHONE EXTENSION CORD
A very handy 5 metre length.
P 0991 ~~$10.00~~
$7.00

C.B. POWER MICROPHONE
For professional 2 Way radios on aircraft, boats, vehicles and also industrial PA systems.
C 0336 ~~$29.00~~ $20

World Famous VIFA Bargains



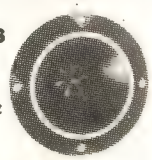
VIFA D 19TD-05-08 TWEETER
19mm dome tweeter with polymer diaphragm. This dome tweeter is VIFA's biggest selling driver.
C 3150 WAS $55 THIS MONTH
$39.00

VIFA C13WG-08-08 WOOFER
5" sandwich coated woofer with rubber surround. High performance driver which can be used in 3 way, 15 litre bass reflex or sealed enclosures.
C 3110 ~~$90.00~~ $65

Piezo Ceramic Speakers

USE WITH SPEAKER SYSTEMS TO 150W RMS

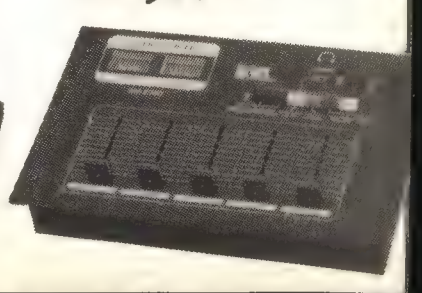
ROUND TWEETER
95.3mm Diam. Suitable for Hi Fi applications. Freq. Res. 3K to 40kHz Sens. 104dB * 2.8V
C 6100 ~~$19.80~~ NOW $10



RECTANGULAR HI FI-PA PIEZO
144.8 x 64mm. Speaker - suitable for Hi Fi and Sound Reinforcement. Full 90 deg. horizontal dispersion angle. Freq. Res. 3K to 40kHz Sens. 110dB * 2.8V.
C 6120 ~~$19.80~~ NOW $10

HIGH PERFORMANCE MINI HEADPHONES
Superb lightweight Hi Fi stereo headphones. Super comfortable foam ear muffs. 29mm samarium cobalt speakers.
C 9002 ~~$24.95~~
$15

STEREO AUDIO MIXER
This brilliant little mixing console is absolutely packed with features. Allows blending of microphones, two phono inputs and either two tape or tuner inputs. • Right and left VU meters. • Separate bass and treble controls. • 5 slide level controls. • Fader control between phono pickups for professional cueing. • Headphone monitor switch. • Talkover facility.
240V Mains Operated
A 2550 ~~$199~~ $160



PHONEORDER TOLL FREE ALTRONICS 008 999 007

ALTRONICS

ELECTRONIC COMPONENTS CATALOGUE

10TH EDITION 1991 $2.00

Toll Free Order Hotline Phone 008 999 007

Jet Express Delivery — Australia Wide

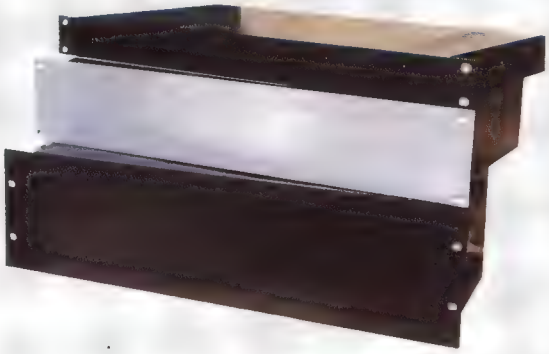
Supplement to Electronics Australia and Silicon Chip Magazine February 1991

Here is a sampling of some of the New and Revised ALTRONICS Products for 1991.

40 Meg Dual Trace Oscilloscope and exciting new range of multimetres. See Test Equipment section.

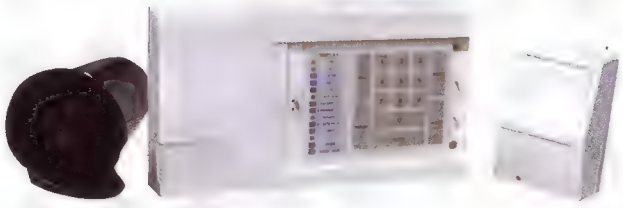
Jumbo Size Instrument Cases great for Inverters, Power Supplies, Amplifiers etc. See Hardware section. Made in Australia.

High Grade Rack Cases all featuring extruded anodised aluminium front panels. Made in Australia.



New Power Supply Project. Just one of the many excellent value home constructor projects for 1991. See Kits section.

Digital Recorder Announcer — Australian designed and manufactured.



All New Wireless Alarm System uses no wires. Ideal for home or for small businesses. See the Security section for a greatly expanded range in 1991.

Dear Customer

Welcome to 1991 and our brand new catalogue of electronic components and products. You will be delighted to see that we've kept prices down once more. Many of our prices have not increased since 1988, indeed some are lower. We have been able to hold down price increases by sourcing direct from the maker overseas and by considerable investment in moulds, dies and tooling for our Australian Made range of products.

At Altronics we are committed to local production where viable. As you flip through this catalogue I'm sure you will be agreeably surprised to see the ever increasing range of Australian products produced by our manufacturing company "Altronic Distributors".

An example where the local product can be superior to imports as well as price competitive, is with our new release of rack cases. Previously purchased from Asia and supplied in bulk by us to many manufacturing firms throughout Australia; we were continually frustrated with delayed delivery and indifferent quality control. After tooling up with Comalco we now produce a range of quality rack cases all supplied with precision, die extruded, superbly anodised front panels.

Our sales to Australian electronics manufacturers of this hardware should increase manyfold and the price is within a percent or two of the previously imported range. I'm convinced that as more companies commit thought to planning and plant investment locally we will see the Australian electronics industry grow from strength to strength. Over a third of our sales are now Australian Made.

I want to specially thank the 1000's of mail order customers who have given us their patronage over the past year. It gives us extra special delight to receive orders from friends in faraway countries — During 1990 we had orders from Kenya, Nigeria, India, Malaysia, Thailand, Singapore, Indonesia, New Guinea, Fiji and quite an amazing volume from New Zealand. At Altronics we process the order the day of receipt if at all humanly possible; our overseas customers are frequently amazed at the speed and efficiency of our mail order service.

For phone order customers the call is now absolutely free — just ring us on 008 999 007, quote your credit card number, give us your order details and presto we deliver to your door in most cases within 24 hours with our famous Jetservice Courier.

We all look forward to providing you with a high standard of service for 1991 and thank you all once again for your valued patronage.

Regards,

Jack O'Donnell

JACK O'DONNELL
Managing Director

See pages 121 & 122 for full Product Index

KIT INDEX

12V Gel Cell Charger....16
Active Direct Injection Box....15
Active Sub Woofer....15
Automatic Charger for Nicads....16
Balanced Input Pre-Amp....14
Basic Car Alarm....7
Beat Triggered Strobe....17
Bench Amplifier....6
Bench Top Power Supply....8
Bridge Adaptor for Stereo Amps....15
Burglar Alarm System....10
Capacitance Meters....4
Car Alarms....7
CD Headphone Amplifier....14
Combination Lock (4 Digit)....10
Crystal Frequency Calibrator....5
DC Electronic Fuse....6
DC-DC Converter for Car Amps....7
Digital Voice Recorder....11
Discolite....17
Drill Speed Controller Mk2....17
Dual Tracking Power Supply....8
Electronic Die....18
Expanded Scale LED Voltmeter....7
FM Radio Microphone....18
FM Stereo Transmitter....18
Frequency Meters....5
Fruit Machine....18
General Purpose Pre-Amp....14
High Capacity Fast Ni-Cad Charger16
High Energy Ignition System....7
House Guard Alarm System....10
Inverters....9
Laboratory Power Supply....8
LED Bargraph Display....14
Line Filter and Conditioner....8
Low Ohms Adaptor....4
Low Cost Dual Tracking Supply....8
Megger Meter....4
Mosfet Power Amp Module 150 Watt....13
PCB Shorts Locator....4
Playmaster "Pro Series One" Amplifier....12
Playmaster "Pro Series One" Power Amp Module....13
Power Transistor Tester....6
Protector Car Alarm....7
Public Address Amplifier 120 Watt .14
RF Detector Probe....6
Signal Generator....5
Solar Generator....16
Speaker Kits....19
Speaker Protection Kit....15
Speech Synthesiser....11
Stereo Amplifier 100/100....12
Stereo Dynamic Range Compressor 16
Studio 200 Stereo Control Unit....13
Sub-Woofers....15
Telephone Off Hook Indicator....18
Telephone Line Grabber....18
Temperature Probe....6
Touch Lamp Dimmer....17
Transistor FET Zener Tester....6
Transistor Tester....6
Twin Range LED Tacho....7
Two Tone Alarm Module....10
Universal High Power Amp Module 13
Ultrasonic Movement Detector....7
Utility Amplifier Module 20 Watt....13
Utility Timer....18
Video Amplifier....17
Video Enhancer....17
Voice Operated Relay....14
Voice Recorder....11
Zener Diode Tester....4

Front Cover Illustration by Nadene Hoy, Graphic Arts Student Curtin University W.A.

PHONEORDER TOLL FREE 008 999 007

PHONEORDER TOLL FREE 008 999 007

KITS

Make your own Test equipment and Save $ $ $

Low Ohms Adaptor For Your DMM

(See SC Feb'88)

Measure accurately down to 50 milli Ohms!

As we all know it's difficult to obtain accurate resistance measurements below 50 Ohms or so with conventional multimeters. This natty little adaptor plugs directly into your DMM via. in-built banana plugs enabling quite accurate measurements to 50 Milli Ohms and less. Full instructions provided.

K 2518 $24.95

Zener Diode Tester

(See ETI May '83)

Take the guess work out of identifying zeners. Simply plugs into your multimeter.

$19.95

K 2620

Ever come across the problem of worn off markings on your Zener Diodes? Or even trying to decipher the IN4XXX numbers? By simply plugging this handy little tester into your multimeter, it allows you to read out the actual Zener voltage of any Zener Diode up to 60 volts & will also test LED's as well as give you a reading of its forward voltage drop. All components mount inside our tiny **H 0205** "ABS" Jiffy Box supplied.

PCB Shorts Locator

(See EA Feb '89)

Find those elusive shorts on PCBs

Have you ever constructed a project, found it did not work and spent hours searching for hair line shorts between tracks?

Here is a simple circuit to help you locate shorted tracks on printed circuit boards by means of a varying audio tone. It is easily built and will cost you a lot less than equivalent commercial units.

FEATURES:
• Cost effective • Simple to construct and use • Audible indication for easy operation • Fully punched and screened front panel • Multitude of uses — Testing motor and transformer windings and heating elements etc.

K 2650 $29.95

Highly Accurate 4-Digit Capacitance Meter

(See SC May '90)

This attractive 4-digit capacitance meter is designed for the workshop or laboratory. It can measure capacitance from 1pF up to 9999uF in seven ranges with an accuracy of better than +/- 1% +/- 1 digit.

Reprinted by kind permission of Silicon Chip Magazine.

Capacitance meters are always a very useful addition to any electronics workshop. While it is true that capacitors are marked with their value, it is often difficult to interpret the coding or worse still, the markings are illegible. On other occasions, a capacitance meter can be used to select matched capacitor values which may be necessary in critical filter and timing circuits.

To use the instrument, you simply connect the capacitor to the test leads and select the appropriate range. The value is then read directly from the big, bright LED display. Seven ranges are available and these allow the unit to measure capacitors anywhere from 1pF to 9999uF. An over-range LED flashes whenever the capacitance value is too large for the range selected.

K 2524 $119.95

Capacitance Meter Adaptor

(See SC Nov'87)

Great for hand selecting exact values for timer circuits etc.

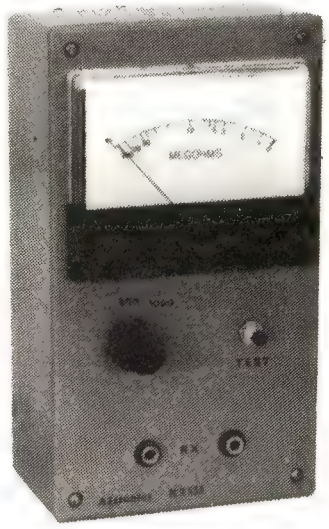
This clever add-on adaptor increases the range of your digital multimeter. It allows measurements up to 2.2uF. Plugs directly into your meter via. inbuilt banana plugs. Kit includes pre-punched silk screened front panel.

K 2520 $24.95

Note: SC and EA are the abbreviations for **Silicon Chip Magazine** and **Electronics Australia Magazine** respectively

Megger Meter

Checks electrical wiring and appliances for insulation breakdown.
(See EA May 89')



Insulation breakdown can be determined by the use of this dual range megohm meter. Ideally suited for checking breakdown in electrical wiring, appliances, transformers, automotive generators and alternators, etc. Breakdown can be measured at either 500V or 1000V depending on the required situation.

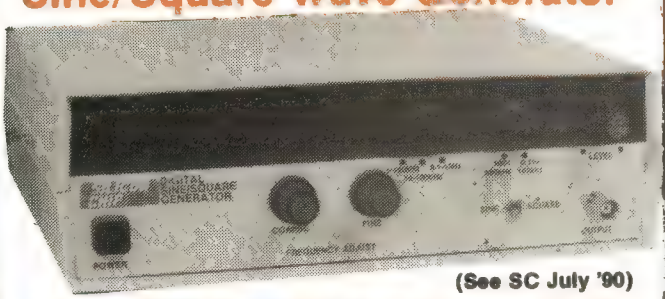
Would suit electricians or technicians work van, tool box or work bench.

K 2555 $79.00

PHONEORDER TOLL FREE 008 999 007

KITS

High Performance Digital Sine/Square Wave Generator



(See SC July '90)

This new Digital Sine/Square Wave Generator uses high speed CMOS ICs and a digital filter IC to produce sine and square waves over the frequency range from 0.1Hz to 500kHz. It also features a 4-digit frequency readout and an output level control.

Like most high quality audio function generators, this digital generator covers a very wide frequency range — from 0.1Hz to 500kHz — and it does so with rock solid amplitude stability. There is no bouncing about of the amplitude as you change frequency (as is inevitable with thermistor stabilised Wien Bridge designs).

Why would you want such a wide frequency range? Well, there are any number of reasons. If you are doing logic design, a clock frequency down to 0.1Hz (ie, one pulse every 10 seconds) can be very handy, since it lets you see the circuit work as each clock pulse arrives.

And if you are working on audio or analog circuitry, the wider frequency range of this generator can be very useful. For example, it can allow you to check the low frequency response of amplifers and loudspeakers. Similarly, the higher frequencies are available for checking the upper response of power amplifiers and other analog circuitry.

The generator has a 4-digit LED readout so you can set the frequency exactly. The output frequency is selectable in four ranges, with a slight overlap between each: 0.1-10Hz; 10-1000Hz; 1-100kHz; and 100-500kHz.

Presentation

The styling of the new Digital Sine/Square Generator is similar to that of the 1GHz Frequency Meter (SILICON CHIP; Nov-Dec. 1987 & Jan. 1988) and the Capacitance Meter (May 1990). It is housed in a plastic instrument case and uses a 4-digit LED display behind a red perspex panel with a Dynamark label covering the lower half of the panel.

It has two knobs for the range selection, two knobs for frequency settings (fine and coarse), and a knob for the output level. There is also a pushbutton ON/OFF switch, a miniature toggle switch to select sine or square wave output, and a BNC socket for the output terminal.

Waveform synthesis

Our new generator produces its sinewaves by a process which can be called waveform synthesis or more accurately, "piecewise linear approximation". In this process, the circuit builds up the sinewave in little steps which are quite accurate in their absolute level but then we need filtering to remove the discontinuities due to the steps.

Before we can use this waveform, it must be filtered and this is done in a switched capacitor filter and a tracking RC filter. These two filters effectively remove all the switching hash associated with the waveform snythesis and the result is an ultra clean sinewave which is fed into the output buffer and level control.

Frequency Range	0.1 Hz-500kHz in four ranges: 0.1-10Hz; 10-1000Hz, 1-100kHz, and 100-500kHz
Output Waveforms	Sine & square
Harmonic Distortion	Less than 0.1% from 0.1Hz-50kHz, 0.27% at 80kHz
Square Wave Rise Time	10ns
Square Wave Fall Time	10ns
Output Level	Sine wave: variable from 0-1.2VRMS Square wave: variable from 0-5V p-p
Output Impedance	600ohm nominal
Load Impendance	600ohm to infinity
Protection	Short circuit protected (indefinite)
Display Accuracy	+/- 2% + 1 digit

K 2547 Fantastic Instrument $175.00

50MHz Digital Frequency Meter

(See EA May '88)

Fantastic for work bench & tool box for less than $100

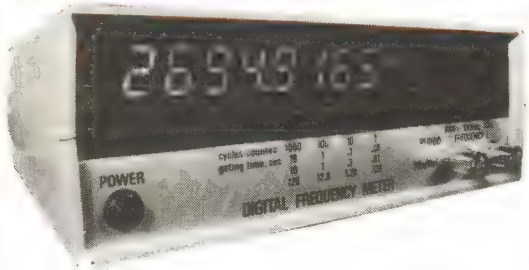
Easy to build & construct this fantastic meter measures to well over 50MHz in 5 ranges. Features high input impedance, overflow LED indicator, KHz & MHz LED indicators. All components mount onto a single PCB, even the selector switch. Altronics Kit comes complete with pre-punched & silk screened front panel. Ideal for use in testing CB radios, TV's & AM radios etc.

K 2510 $99.00

1GHz Digital Frequency Meter

(See SC Nov '87 Jan '88)

This superb 1GHz Frequency Meter will out perform many other instruments twice its price.



FEATURES:

• Professional machined and screen printed red perspex front panel • Easy to assemble & construct • No special tools required • Bright Hewlett Packard 8 digit display • Electronic switch latching • High Performance IC's • High Quality Components

SPECIFICATIONS:

Operational Modes: Period, Freq. to 10MHz, Freq. to 1GHz.
Freq. Range: 10Hz-1GHz (1.7GHz type.) in frequency mode; 10Hz-2.5MHz (5MHz type.) in period mode.
Gating Times: 0.01, 0.1, 1 and 10 seconds (10MHz & 100MHz); 0.128, 1.28, 12.8 & 128 sec. (1GHz range).

K 2515 $299.00

Crystal Frequency Calibrator

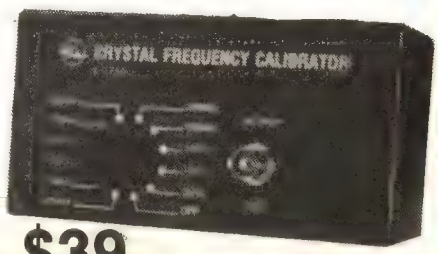
(See EA 1990)

A really excellent piece of test equipment for checking frequency of timing signals in your workshop or in the field.

Here's an ideal circuit for a handy frequency and time period calibrator. Compact and simple to construct, it generates eleven different standard frequency/timing signals, from an internal crystal. Ideal for calibrating frequency counters, oscilloscopes timers and realigning radio receivers.

FEATURES:

• Crystal locked frequencies for accuracy
• Front panel fully punched and screened
• Simple to calibrate
• 12V DC operation



K 2750 $39.50

PHONEORDER TOLL FREE 008 999 007

KITS

Transistor FET Zener Tester

(See EA Feb/Mar'88)

New updated circuit incorporates facilities for testing transistors FET's and Zeners etc.

FEATURES:

- Gain
- Leakage
- Breakdown voltages
- Zener voltage
- Polarity - NPN/PNP

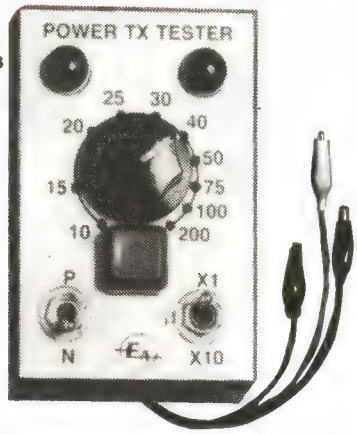
K2527 **$55.00**

Power Transistor Tester

(See EA May '88)

Hand select transistors for power output stages.

This tester has been designed specifically for bipolar transistors with a continuous collector rating of at least one amp. Previous transistor tester kits are not suitable for testing power transistors. Super single operation allows for testing of current gain & Vbe of all popular power transistors even power Darlingtons. Suitable for both N.P.N. & P.N.P. types. Altronic Kit comes complete with screened box.



K 2532 **$24.95**

Bench Amplifier

(See ETI April'80)

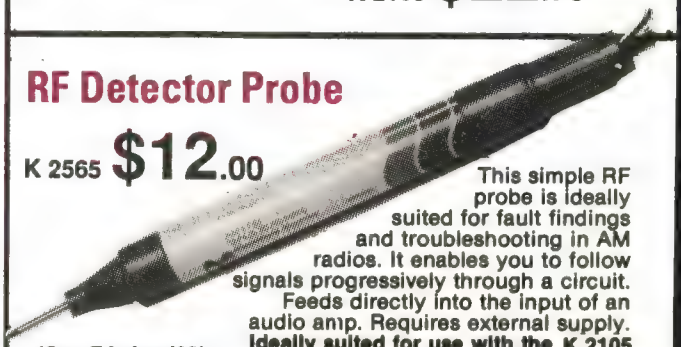
Invaluable for testing all your audio projects. This amplifier is a well proven design with low distortion and high reliability. One of the most useful pieces of equipment in an electronic work-shop is a simple amplifier module to test circuits.

- 250 milli watts output into 4 Ohms
- Runs off single 9V supply
- Can give 0.5 watts when run on 12V + heatsink
- Complete kit housed in "ABS" jiffy box.

K 2105 **$22.70**

RF Detector Probe

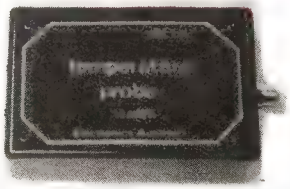
K 2565 **$12.00**



This simple RF probe is ideally suited for fault findings and troubleshooting in AM radios. It enables you to follow signals progressively through a circuit. Feeds directly into the input of an audio amp. Requires external supply. **Ideally suited for use with the K 2105 Bench Amp/Signal Tracer (above)**

(See EA Jan '88)

Low Cost Temperature Probe



Here's an easy to build probe which adapts a multimeter or electronic voltmeter into a general purpose thermometer. **Measures accurately from -20 deg. C to =120 deg. C.**

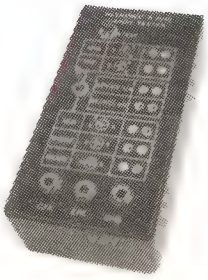
K 2570 **$21.95**

Transistor Tester

(See EA Aug'83)

Checks transistor in circuit "NO NEED TO UNSOLDER SUSPECT TRANSISTORS"

Have you ever de-soldered a suspect transistor, only to find that it checks out OK?



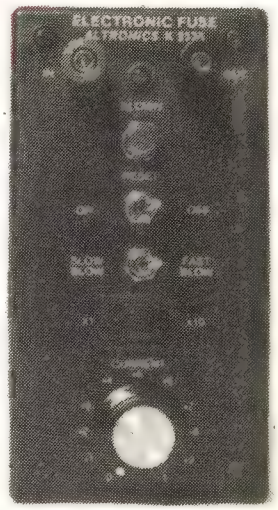
FEATURES:

- Tests both NPN and PNP transistors in circuit at the touch of a switch
- Tests Diodes and SCRs as well
- No need to switch between NPN and PNP - it's automatic
- LED indication to show condition of device.

K 2530 **$17.50**

DC Electronic Fuse

(See EA Nov'87)



This unit simply clips across the DC fuse holder. Offers protection adjustable from 0-10A in 2 ranges. In essence it's an adjustable DC circuit breaker.

FEATURES:

- Fast blow - slow blow setting
- Manual reset button
- LED fuse tripped indicator
- Operates off single 9V battery (not supplied)
- Two current settings easily adjustable via a pot and calibrated scale.
- Housed in a rugged Jiffy Box.

A must for prototyping and service work. No Electronic workshop should be without one.

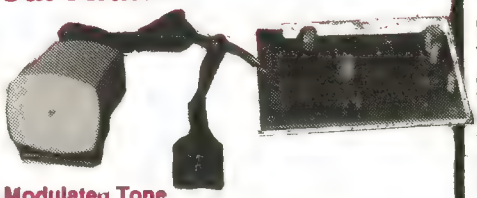
K 2535 **$39.50**

PHONEORDER TOLL FREE 008 999 007

KITS

Screecher Car Alarm

(See EA Aug'86)



K 4360

$49.50

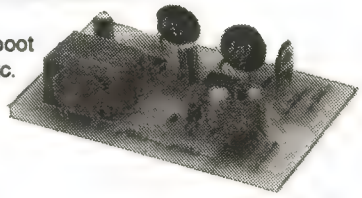
Ear Splitting 110db Modulated Tone

Now our top selling Car Alarm. Two Sensor inputs - Normally open and normally closed enable simple connection to door, bonnet, boot light, switches etc.

Basic Car Alarm

(See ETI Oct '87)

This ingeniously simple alarm operates by detecting any voltage drop in the electrical system of your vehicle, eg operation of courtesy light, boot light, hot-wiring of ignition etc. will activate alarm.



FEATURES:

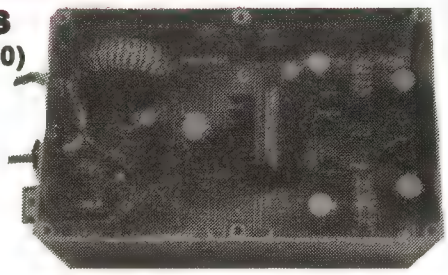
- Flashing LED to deter would be thieves and vandals.
- Installed in minutes.
- Easy to build.

K 4350 $15.00

DC-DC Converter for Car Amplifiers

(See SC Dec '90)

NEW IN '91



This converter can be used to power virtually any amplifier module with an output of up to 100 watts.

As it stands, the circuit can be used to power twin 50W amplifier modules or a single 100 watt amplifier module, the latter possibly being used to drive a sub-woofer loudspeaker.

K 4100 $139.50

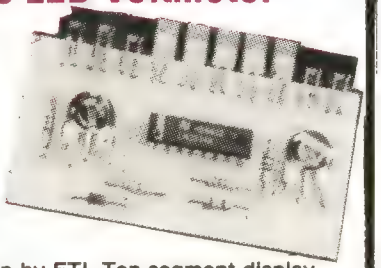
Expanded Scale LED Voltmeter

(See ETI Project 326)

Easy to bulid

Covers Range

10.5V to 15V



K 4326 $16.00

Brilliant single chip design by ETI. Ten segment display indicates exact voltage in 0.5V increments from 10.5V to 15V.

- Invaluable where voltage monitoring is essential, i.e. NiCad battery charging circuitry etc.
- Great as "state-of-the-art" car battery voltmeter.
- Easily configured to provide a "Voltage High" or "Voltage Low" alarm output.

The Protector Car Alarm

(See SC Feb '88)

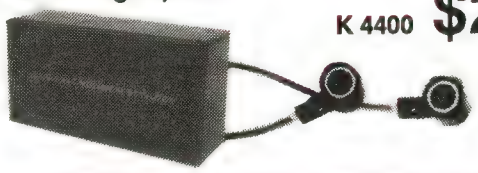
This refined car burglar alarm has about every feature you could possibly want to keep would be thieves away. FEATURES: • Internal & External Sirens • Dash lamp flasher • Battery back up • Delayed & Non delayed inputs • Ignition killer • Easy to build and install.

K 4370 $129.00

Ultrasonic Movement Detector

(See EA Aug'84)

K 4400 $29.50



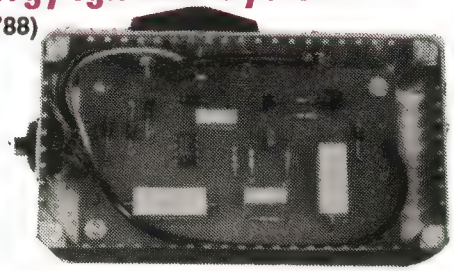
Ideally Suited to K 4370. Takes Minutes to Install

This Ultrasonic Movement Detector provides added protection against illegal entry via an open window etc. Connects directly to any alarm with a normally open input.

- Detects any movement up to 3 metres within an angle of 30 deg.
- Will operate directly off 12V i.e. Car Battery etc.

High Energy Ignition System

(See SC May'88)



K 4015

$58.50

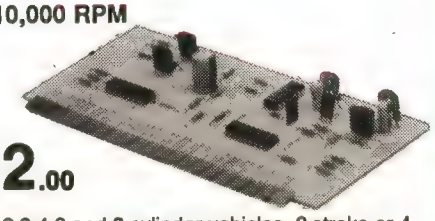
Keep Your Car In Top Tune

This "state of the art" electronic ignition system uses the same semi-conductors as found in modern motor cars. Extends the life of plugs and points. Increases power and improves fuel economy. Compatible for 4,6,and 8 cylinder engines. Install one into your car and start saving $$$ from the very first day.

Twin Range LED Tacho

(See ETI Aug '80)

0-1000 RPM/0-10,000 RPM



K 4324 $32.00

Unit suitable for 1,2,3,4,6 and 8 cylinder vehicles, 2 stroke or 4 stroke. Fully compatible with conventional, CDI and transistorized ignition systems. Includes protection circuitry to prevent noise and coil circuit damaging the electronics.

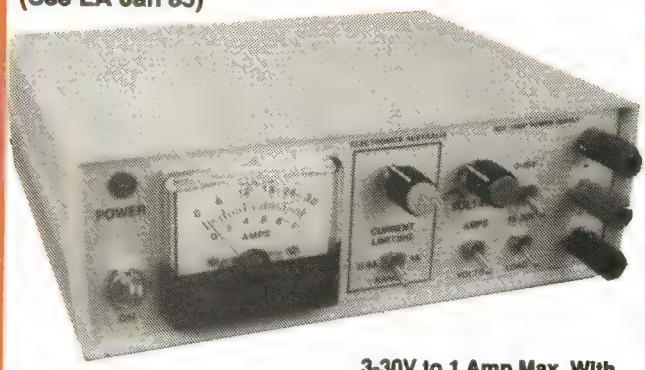
Display flashes when over-revving occurs. Only 3 connections to electrical system required.

PHONEORDER TOLL FREE 008 999 007

KITS

Bench Top Power Supply

(See EA Jan'85)



3-30V to 1 Amp Max. With Variable Current Limit.

FEATURES:

- Output variable between 3 and 30V
- Short circuit protection
- Full 1 amp output over entire voltage range
- Load switching
- Current limiting fully variable-twin selectable ranges-dual scale meter
- Separate earth terminal provided
- Housed in our Deluxe "ABS" instrument case

SPECIFICATIONS:

- Output Voltage - 3 to 30V
- Output Current 0 to 1 amp (fully variable)
- Load Regulation - Better than 0.2% from 0 to full load
- Output Ripple - Less than 2mV RMS

K 3210 $105.00

Line Filter and Conditioner

(See EA July'88)

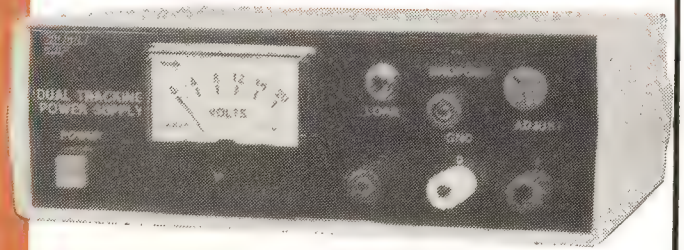
K 6040

$39.50

Simple, easy to build and low cost too - Helps eliminate those annoying clicks and pops on your stereo and TV when the fridge compressor switches on and off. Helps prevent computer crashes from power spikes and glitches. Altronics customised version housed in strong sturdy Jiffy Box. Nickel sprayed for EMI shielding.

Low Cost Dual Tracking Supply

(See SC Jan'88)



Ideal For Experimenting And Prototyping With Memory, Logic And Op Amps

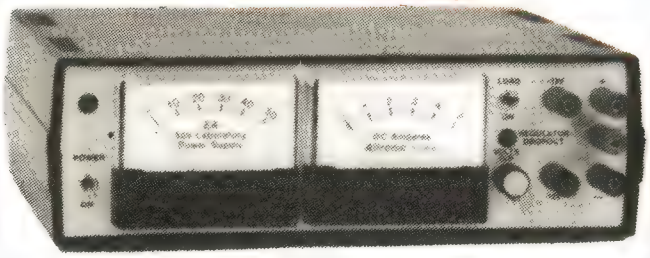
FEATURES:

- Adjustable + or - 18.5V at 1.7A
- Volt Meter
- Floating Ground
- Dropout Indicator
- Load Switch
- Compact Sturdy "ABS" instrument case

K 3325 $99.00

Laboratory Power Supply

(See EA May'85) 3 - 50 Volts at up to 5 Amps



Designed by Electronics Australia, this supply has been one of our most popular ever. Our superb version incorporates the latest refinements and is now housed in an attractive, tough "ABS" instrument case. This all new compact version has been made possible by use of a high efficiency toroid power transformer. So you win four ways - less heat, less weight, greatly enhanced appearance and easier to build.

EXCLUSIVE TO ALTRONICS: • Deluxe instrument case • Attractive silk screened front panel • Fully drilled and punched chassis — No holes to drill • Front panel supplied to accommodate K 3302 option if required • Heatshrink tubing supplied for critical component termination.

SPECIFICATION:
Output Voltage: 3 to 50 volts
Output current up to 5 Amps (max. 175W)
Floating outputs isolated from ground
Ripple less than 90mV p-p at max.
Employs Dual Meters: No switching from one to the other.

K 3300 $195.00

10 TURN OUTPUT VOLTAGE CONTROL OPTION. (K 3300 is normally supplied with standard pot)
K 3301 $29.50

AUXILIARY + AND - 12V OUTPUT TERMINALS OPTION Fixed Outputs Independent of Variable Main Output
K 3302 $14.50

0-50V + and - 1.5A Dual Tracking Power Supply

K 3380 $229.00 **(See SC April '90)**

This NEW dual tracking power supply is a must for your workbench. The two rails track each other exactly on any voltage. Precise voltage is obtained with the multi-turn rotary control. It also has a clear display and meter movement, a dropout indicator and load ON/OFF switch. Housed in a medium sized instrument case with a silver anodised pre-punched and screened front panel.

Type	Dual tracking with switchmode pre-regulators for high efficiency
Output Voltage	0 to +/-50V
Output Current	1.7A from 0 to 87V; 1.5A at 19V; 1A at 100V
Tracking Accuracy	Within +/-1%
Load Regulation	Better than 500mV at +/-50V and 1A
Line Regulation	Better than +/-5mV for mains voltages from 220-260VAC
Ripple output	Less than 3mV p-p at full load
Protection	Fully protected against output short circuits and forward and reverse voltages connected to the output; fuse protection for the power transformer

PHONEORDER TOLL FREE 008 999 007

Get 240V AC MAINS POWER From Your 12V Battery With These Handy Inverter Kit Sets

Depending on power capacity the various models will power a Microwave Oven, TV Set, Hi Fi turntable, AC Lighting, Electric Drill, Angle Grinder and 100 and 1 Appliances

Powerhouse 600W Inverter

(See EA Dec'87)

Go anywhere 240V mains power from your car or truck battery with these fantastic DC to AC Inverters

This inverter has the capability to produce 600 watts of mains power which will run a fantastic array of appliances. It would be ideally suited to running power tools, lighting (including fluros) electric motors and much more. It can be either used as a portable unit or permanent fixture. A must for farming, camping, mining, boating, remote settlements and wherever else 240V power isn't available.

FEATURES:
• Can be configured to operate off either 12V or 24V DC • Very little internal wiring • Manual or auto start facilities • Low battery cut out • Compact toroid transformer • Now with study ABS case.

K 6770
$499.00
KIT VERSION

NEW IMPROVED CIRCUIT

K 6774
$625.00
12V INPUT

K 6775
$625.00
24V INPUT

300 Watt Inverter with Auto Start

(See EA April '88) **Operates From 12V Car Battery**

• **Super Compact** - kit is supplied in Altronics H 0482 tough ABS case • **Uses High Efficiency Toroid Transformer** thus keeping down heat dissipation, battery drain and weight • Auto start draws power from your battery only when appliance is plugged in and "turned on" i.e. battery can be left permanently connected if req. • **Voltage regulated** • **Current regulated** • **Current overload** unit self limits — Single PC Board construction - easy to build as there is very little internal wiring.

Complete Kit **K 6750** **$279.00**

Fully Built & Tested **K 6755** **$379.00**

12/240V 40 Watt Inverter

(See EA Aug'85)

This inverter is ideally suited for powering low wattage mains appliances from the car battery while camping. This considerably improves the comfort level of the civilised camper. Similarly, it has uses in boating. Typically, it can be used to power an electric shaver, electric blanket, electric can opener or a 40W light bulb. Alternatively, back in the home (or still on the camp site), frequency sensitive items such as belt or idler driven turntables can be powered at a very precise crystal controlled frequency for accurate sound reproduction if speed variation over a small range is required, then a switch is provided to change from the crystal based 50Hz signal to a variable oscillator.

K 6705 **$99.00**

Note: SC and EA are the abbreviations for **Silicon Chip Magazine** and **Electronics Australia Magazine** respectively

Doubles as battery charger under normal mains conditions

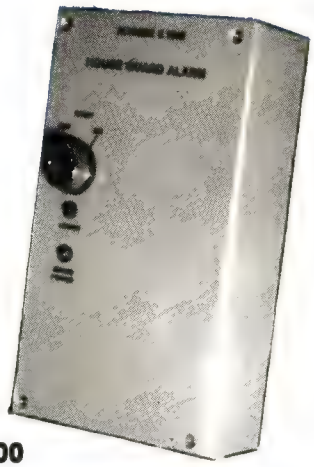
KITS

GREAT FOR SMALL BUSINESS PREMISES TOO!

House Guard Alarm System (See EA March/April'89)

Fantastic New Alarm Project - Easy to build as it all assembles on a single PCB.

Includes 12V 1.2 amp hour inbuilt sealed lead-acid backup battery.



With todays high incidence of crime it makes sense to protect your home whilst it's unoccupied.

FEATURES:

- Delayed and instant input
- Entry and exit delay
- Panic alarm input
- Battery backup
- Line monitoring
- Soft pre-alarm
- Two sector or 4 sector versions available
- Lamp telltale output
- Auxilliary relay for external siren etc.
- Key switch operation
- Operates on virtually any type of sensor.

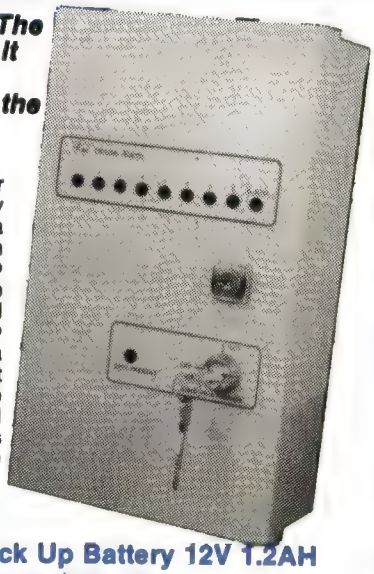
All components mount on a single PCB including transformer. Complete kit housed in H 0152 Jiffy Box.

K 1910 Two sector system $89.00

K 1912 Four sector system $119.00

Protect your Home or Business from Intruders with this "State of the Art" Burglar Alarm System (See EA Jan/Feb '85)

Over the last few years, house break-ins have increased dramatically. The recovery rate of stolen goods is very low. Now more than ever before, it makes extremely good sense to build and install this ingenious Multi-Sector System. This unique alarm system incorporates the features of the more expensive commercial models — at a fraction of the price.



FEATURES:

• Alarm has 8 separate input circuits — 8 sectors can be monitored independently. • Each input circuit is provided with an indicator LED and a sector On/Off switch. • Individual sector isolation allows the user to have some areas of the premises inhabited while others remain protected. • Inputs accept both normally closed and normally open sensors. • Two inputs provided with any entry delay (between 10-75 seconds). • Alarm is disabled by front panel key switch. • Internal trip warning buzzer. This buzzer is pre-settable between 5 and 55 seconds prior to Alarm. • Unique circuit detects automatically when any N/O or N/C loops are either open circuit or dead short e.g. someone trying to bridge reed switches etc. • Automatic muting of the siren driver when under test. • Fully variable exit delay — between 5 and 45 seconds. • Will drive a separate external horn speaker. • Alarm output variable between 1 & 15 mins. • When triggered, gives a switched double pole output for connection to external devices e.g. Bells, TV Camera etc. • Switched output can be used to send a silent alarm through an auto-dialler circuit or similar. • Full battery back up available via 12V-1.2AH battery. • Alarm will operate for approx. 2 days with mains disconnected. • Supplied in an attractive functional security case.

Kit (Less Battery Back Up)

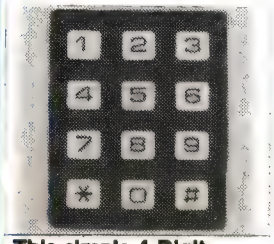
K 1900 $179.50

Back Up Battery 12V 1.2AH

S 5065 $29.95

Four Digit Combination Lock

(See SC Dec '90)



This simple 4 Digit Combination Lock uses only 3 IC's, and is bound to prove useful in many applications. Such as accessing alarm systems, electronic doors, ignition killers or just about anything that comes to mind.

The code to enable the output is four digits long. All the digits from 0-9, and even the '*' key can be used in the combination. (This gives you 14641 possible combinations).

The circuit is designed to automatically reset if any key is pressed out of sequence during entry of the code.

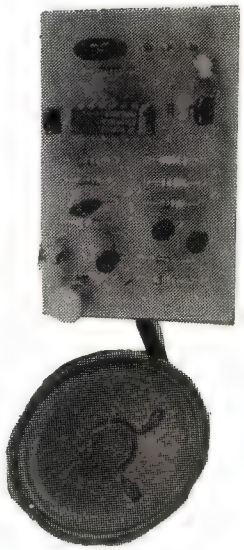
Power for the combination lock can be derived from any 11-30 volts DC power. The circuit also has provision for battery back-up, which is obtained from 8 x AAA or a single 9V Nicad battery.

K 1925 $39.95

Electrical switchplate and batteries not supplied.
Ideal for use with Electrical Door Strike S 4390.

Two-Tone Alarm Module

(See SC Jan '91)



You've just finished designing an alarm project, and you need an ear-catching alarm to go with it. If that's the case, then this alarm sounder is the go. It produces a melodic two tone sound, packs quite a punch for its size and uses only one CMOS IC.

It has only one input point and is simple to operate. Just connect the control input to the positive supply rail to make the alarm sound, and ground it to turn the sound off again.

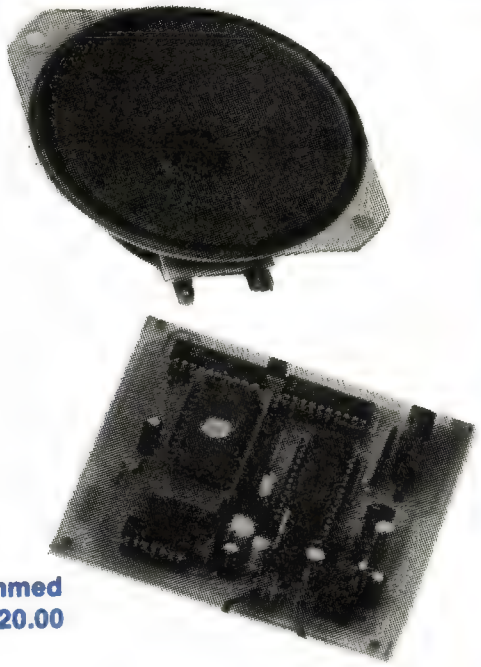
K 1940 $15.00

PHONEORDER TOLL FREE 008 999 007

Speech Synthesizer

(ETI March '88)

Here is a self contained Speech Synthesizer that does not require a computer to control it.



This small, simple circuit contains all the necessary components to make your favourite possessions speak. It can be connected to almost any appliance, vehicle or home remote control system to let you know when the kettle has switched off, the doors are locked or the water in the radiator is boiling. The inputs are coded and priority message reading means warnings are heard instead of greetings etc if two messages are sent at the same time. Blank Eprom included to allow you to program the messages you want.

FEATURES:
- Self contained circuitry
- Simple double-sided PCB
- Comes complete with speaker and Eprom
- 12V DC operation

K 9500 $95.00

K 9502 Pre-Programmed Eprom for K 9500 $20.00

The Days Of Tape Decks Are Numbered

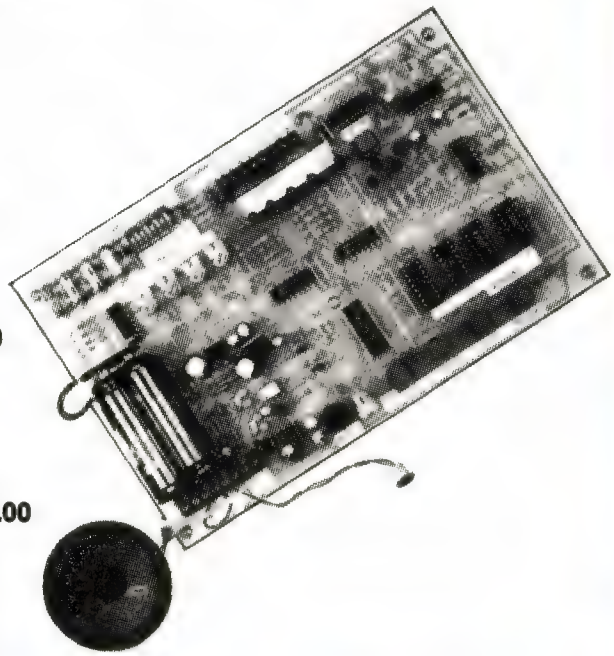
This Digital Recorder delivers astonishing reproduction of voice and/or music without one single moving part!

Digital Voice Recorder

(SC Dec'89)

Here is a digital voice recorder that can store 4 different signals, voice, sound or a music source of up to 30 seconds each or one recording of up to 2 minutes.
This new digital voice recorder uses a special voice recorder/playback IC and 7 other IC's making it both simple to construct and incredibly economical.
Separate 256K Ram chips are used for each channel. These memories can be ganged to provide a total of 2 minutes of message time. There are 4 trigger inputs so that a message can be stored when a certain condition occurs.
Battery backup is provided so that the messages are retained when main power is off.

Typical applications include:
- Alarm system messages
- Sales messages for customers put "on hold"
- Experimental telephone answering machine
- Door station announcer
- Talking displays for shops
- Emergency warning message announcement
- Operation instructor for machinery etc.
- Countless other applications where voice or music is required.
- $100's cheaper than imported digital recorders



K 9550 Kit complete — PCB Format $129.00

For those who want a professional appearance - stand alone product, we can supply with out Deluxe H 0483 Instrument case and fully punched and screen printed front panel.

K 9555 Kit complete — with Inst. case $149.00

Note: SC and EA are the abbreviations for Silicon Chip Magazine and Electronics Australia Magazine respectively

KITS

Playmaster "Pro Series One" High Power Amplifier

(See EA December '89, January '90)

This new design has been carefully developed to produce a high definition audio output with reliability, ease of construction and low cost. Kit comes complete with all components, toroidal transformers and case. The diecast front panel doubles as the heatsink. The chassis is supplied in kit form and assembles in minutes.

FEATURES:
• Individual toroidal transformers for each channel for low residual hum. • Individual power supply components for each channel. • Diecast front panel doubles as the main heatsink. • Straight forward construction. If you can use simple hand tools you can build this project. • Mosfet technology for ultra-high performance. • Overload indicator illuminates when distortion is above 0.05%.

Amazing 190W IHF into 8 Ohms!

K 5070 **$599.00**

PERFORMANCE
Power Output (per channel with both channels driven)
Continuous: 140W RMS into 8 Ohm - 200W RMS into 4 Ohms
IHF Pulse Power: 190W into 8 Ohms - 320W into 4 Ohms
Harmonic distortion:
0.005% at 100W RMS into 8 Ohms
0.007% at 140W RMS into 8 Ohms
0.008% at 200W RMS into 4 Ohms
Intermodulation distortion:
0.004% at 100W RMS into 8 Ohms
(4:1 ratio at 50Hz and 7kHz)
Frequency response
10 Hz to 100kHz (-3dB points)
Signal to noise: More than 100dB below rated output (unweighted)
Sensitivity: 0.83V RMS for 100W into 8 Ohms
Overload Indicator: Activated if output distortion exceed 0.05% (regardless of load impedance)
• Input impedance approx. 33K Ohms • Output slew rate more than 60V/us • Damping factor greater than 50.

'Pro Series One' High Energy

Super High Power Version with an Incredible 200 Watts PLUS per Channel into 8 Ohms

The Pro Series One design is also available with increased capacity power supplies, 350VA Toroid transformers and higher voltage Mosfet output devices. The front panel heatsink has also been upgraded to a higher dissipation type. For those with super, high power applications, this is for you!

K 5072 **$775.00**

Calling All Audio Purists !

This Great New Amp from Silicon Chip is For You

Studio 200 Series 100 Watts Per Channel Power Amplifier

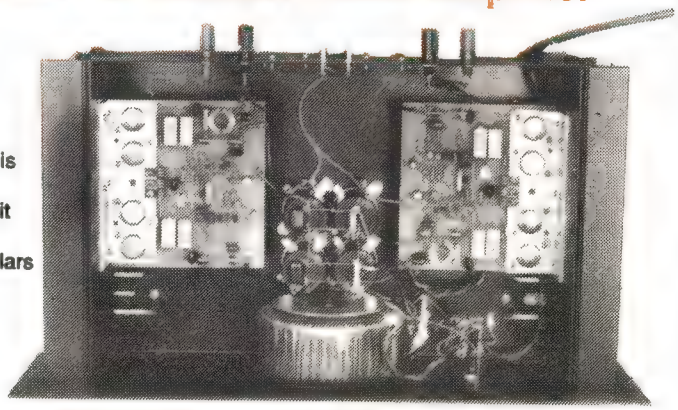
100/100 Stereo Amplifier

(See SC Feb'88)

Sensational, natural, uncoloured high definition audio is the result from this great design by the team at Silicon Chip Magazine. The sound quality and overall specifications of this amplifier will compliment any sound system. The overall mechanical design and pre-drilled chassis means that this kit virtually falls together and should only take the average constructor about 6 hours to build. Why pay hundreds of dollars when you can build it yourself and end up with a quality professionally finished amplifier?

FEATURES:
- In-Built speaker protection
- Toroidal Transformer (Low Hum)
- Black Satin Finish
- Low leakage power supply capacitors
- Housed in Rugged Custom Chassis

SPECIFICATIONS:
Output Power 100W into 8 Ohms
Frequency Response (at 1W) 20Hz-100KHz + or -1db
Input Sensitivity 1.25V
Harmonic Distortion (20Hz-20KHz) 0.01%



Signal to Noise Ratio 105db or better
Protection 5A fuses plus RDE245A Polyswitch
Damping Factor (without Polyswitches) 100
(with Polyswitches) 100
Stability Unconditional

K 5010 **$425.00**

Note: SC and EA are the abbreviations for **Silicon Chip Magazine** and **Electronics Australia Magazine** respectively

PHONEORDER TOLL FREE 008 999 007

Studio 200 Stereo Control Unit

(See SC June/July'88)

Outperforms Commercial Units Costing $600 Or More

The Studio 200 Stereo Control unit is companion to the studio 200 stereo power amplifier (and other power amps). It features slim 1u rack mount profile, treble, stereo mono switch and volume control. Inputs include phono, tuner, V.C.R. & tape loop. Virtually all components mount on PCB's, making assembly and construction a breeze. Altronics kit includes fully professionally punched and printed panels.

SPECIFICATIONS:

Frequency Response: Phono inputs: RIAA/IEC +/-0.3db from 20Hz to 20kHz - High level inputs: within +/-1db from 10Hz to 100kHz.

Total Harmonic Distortion: Less than .005%,20Hz to 20kHz, at rated output level for any input or output.

Signal-to-Noise Ratio: Phono (moving magnet):86db unweighted (20Hz to 20kHz) with respect to 10mV input signal at 1kHz and rated output with 1k Ohm resistive input termination; 90db A-weighted with respect to 10mV input signal at 1kHz and rated output with 1k Ohm resistive input terminal. High level input (CD,Tuner etc): 104db unweighted (20Hz to 20KHz) or better with respect to rated output (volume at maximum) with tone defeat switch in or out; 107db A-weighted, with respect to rated output (volume at maximum) with tone defeat switch in or out.

Separation Between Channels: -62db at 10kHz; -81db at 1kHz; and -93db at 100Hz with respect to rated output and with undriven channel input loaded with a 1k Ohm resistor.

Input Sensitivity:

Phono inputs at 1kHz	4.3mV
High level inputs	240mV
Input impedance (phono)	50k Ohm shunted by 100pF
Input impedance (CD,etc)	50k Ohm
Overload capacity (phono)	150mV at 1kHz

Output Level: Rated output, 1.25V; maximum output,8.4V RMS; output impedance, 470 Ohm; headphone output, 40 milliwatts into 8 Ohm phones, 100 milliwatts into 32 Ohm phones.

Tone Controls: Bass, +/-10db at 100Hz; treble, +/-12db at 10kHz

Phase: With tone controls defeated, non-inverting (ie,zero phase shift) from phono to main output; non-inverting from high level inputs to main outputs: non-inverting from all inputs to tape out. With tone controls in circuit, inverting from phono and high level inputs to main outputs (ie, 180 deg.phase shift).

K 5015 $229.00

20 Watt Utility Amp Module

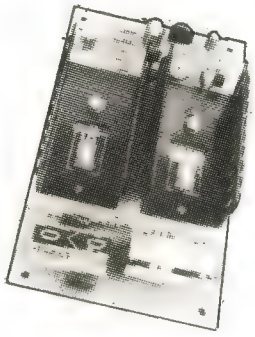
(See EA Nov '84)

All components mount entirely on one printed circuit board, even the heatsinks!

Design uses discrete transistors and is very easy to build. In addition, the module presents an ideal opportunity for the hobbyist to gain an understanding of how an audio amplifier works.

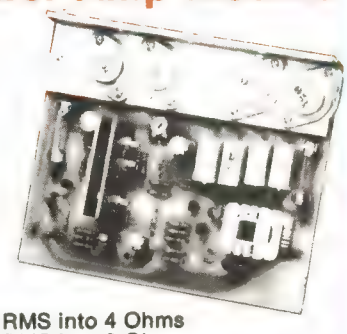
DC Supply	Pwr into 8 Ohms	Pwr into 4 Ohms
20V	4W	6.6W
30V	8W	12W
35V	15W	19W

SPECIFICATIONS:
Input Impedance 100K Ohm approx. **Output Impedance** 0.1 Ohm approx. **Signal to Noise Ratio** 58dB with respect to 1W **Freq. Res.** -3dB @ 45Hz and 68Hz **Load Imp.** 4 Ohms or greater. **Quiescent current** 22mA with 8 Ohms load.



K 5112 $26.95

Mosfet Power Amp Module 150 Watt



Here is a general purpose power Amplifier module suitable for Hi Fi, guitar and PA applications employing sturdy reliable MOSFET'S in the output.

(See ETI Jan '81)

Power Output:	150W RMS into 4 Ohms 100W RMS into 8 Ohms (At onset of clipping)
Freq. Response:	20Hz to 20kHz +0 -0.5dB 10Hz to 60Khz +0 -3db Measured @ 1W & 100W levels
Input Sensitivity:	1 Volt RMS for full output
Hum:	98dB below full output
Noise:	114dB below full output
Total Harmonic Distortion:	0.006% @ 1kHz 120W 0.03% @ 10kHz 120W
Stability:	Exceptional (tested to full output driving 3.3uF into short circuit at 10kHz).

K 5120 $79.00

Playmaster Pro Series 1 Power Amplifier Module

(EA Dec '89)

This amplifier module has all the same high spaces as the Stereo Pro series 1 (K 5070), but in short form i.e. One mono module — no power supply or case. Fantastic for use in Juke boxes, amplifier racks (multi-amplifier setups) discos etc.

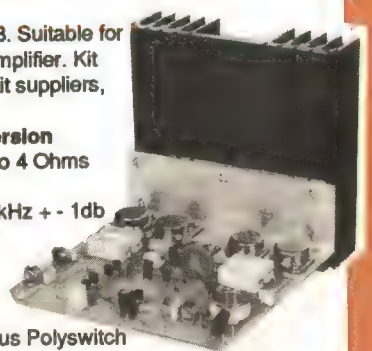
K 5170 $85.00

Universal High Power Amplifier Module

(See SC Dec'87)

All components, including output transistors mount on a single PCB. Suitable for high quality guitar amp, public address or in a high fidelity stereo amplifier. Kit includes angled heatsink bracket, main heatsink and unlike other kit suppliers, the In-Built Polyswitch for loudspeaker protection.

	100W Version	150W Version
Output Power	100W into 4 Ohms	150W into 4 Ohms
Frequency Response (at 1 W)	20Hz-50kHz + - 1db	20Hz-50kHz + - 1db
Input Sensitivity	870mV	870mV
Harmonic Distortion (20Hz-20kHz)	0.1%	0.15%
Signal to Noise Ratio	100db	100db
Protection	Fuses plus Polyswitch	Fuses plus Polyswitch



100W Version K 5140 **$69.00** 150W Version K 5150 **$99.00**

PHONEORDER TOLL FREE 008 999 007

KITS

120 Watt Public Address Amplifier

(See SC Nov'88)

High Performance Low Noise P.A. Amplifier

This professional quality Public Address Amplifier offers performance equal to or better than commercial units at about half the price. Amplifiers using 100V line output are used extensively in everyday situations where numerous speakers and long output lines are employed. Ideally suited for Halls, Churches, Clubs & even temporary setups.

Inputs 2 balanced microphones with 3 Pin XLR connectors. 2 Auxiliaries suitable for direct connection to CD player, tuner etc.

Outputs 4 Ohm, 8 Ohm or 100V line output configuration

Power Output (RMS) 125 Watts into 4 Ohms; 90 watts into 8 Ohms; 120 watts into 100V AC line.

Frequency Resp. 30Hz to 30kHz (-3db) with line output transformer (all inputs)

Input Sensitivity 340mV (Aux 1, Aux 2)
0.5mV for balanced microphones
0.5mV for unbalanced microphones

Input Impedance 50k Ohm for line inputs (Aux 1,Aux 2) 600 Ohms for balanced microphones - 300 Ohms for unbalanced microphones.

Harmonic Distortion Less than 0.3% from 20Hz to 20kHz.

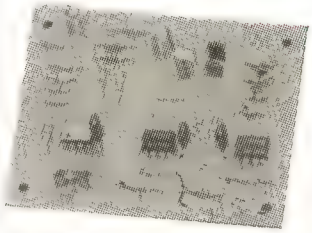
Signal-to-Noise Ratio -56db unweighted for microphones. -72db unweighted for line inputs.

Stability Unconditional.

K 5020 **$499.00**

Balanced Input Pre-Amp

(See ETI Dec'82)



High Performance balanced line input pre-amp - makes a superb Mic input stage -30db gain.

ALTRONICS KIT FEATURES:

- 5534 AN's for super low noise
- TL 071 Bifet Op Amp (Great common mode rejection ratio) genuine Texas Insts.

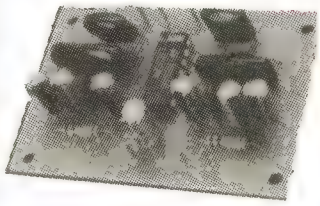
SPECIFICATIONS:

- Frequency response (10k load) - 12Hz-60kHz +0.1db
- T.H.D. (output) -100Hz 0.007%-1kHz 0.006%-10kHz 0.012%
- Input Impedance - nominal 560 Ohms
- Output Impedance - nominal 260 Ohms
- Common mode rejection ratio - easily adjustable to 80db

K 5530 **$19.95**

General Purpose Pre-Amp

(See ETI July'76)



Based upon a Single LM 382 IC

This unit contains all necessary components to complete:-

- A Phono Pre-amp with RIAA frequency response
- A tape Pre-amp with NAB response
- A microphone Pre-amp with either 40,55 or 80db of gain
- Or a Pre-amp for just about anything!

Pre-amp may be powered by any DC Voltage between 10 and 40 volts. The output being automatically biased to about +6 Volts. high 100db Ripple Rejection.

K 5510 **$18.50**

CD Headphone Amplifier

(See SC April'88)

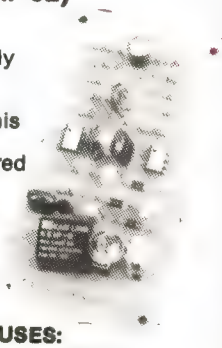
Adds headphone facility to your CD player

This clever design suits any CD player and low or high impedance headphones. The circuit offers very low noise distortion. The signal output of the CD is not degraded. All inputs/outputs via standard RCA sockets. Requires external 12V AC plug pack.

K 5350 **$25.50**

Voice Operated Relay

(See EA April '82)



Professional design eminently suited to commercial applications. This versatile Vox circuit is triggered whenever a noise or sound is made causing a relay to close.

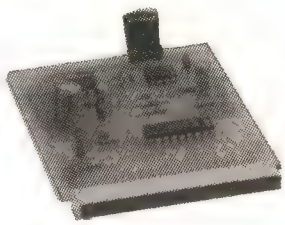
THINK OF THE USES:

- Controlling tape recorders
- Slide projectors
- Eliminate the need for a press to talk button on transmitters
- Turning on external porch lights
- Paging systems
- Hands free intercom switchover reaction sensitivity and "On Time" are fully variable

K 5540 **$22.00**

LED Bargraph Display

(See ETI Oct '83)



This easy to build level meter displays a peak reading from -21db to +6db in either dot or bar mode. Incorporates our exclusive imported LED Bargraph Module giving a very professional finish. Great for the car, home HI FI, disco console, mixers, audio monitoring.

K 5412 **$23.95**

Note: **SC**, **EA** and **ETI** are abbreviations for **Silicon Chip Electronics Australia** and **Electronics Today International Magazines** respectively.

PHONEORDER TOLL FREE 008 999 007

KITS

Bridge Adaptor for stereo amplifiers

(See EA June '85)

With this simple circuit it is possible to make any stereo amplifier deliver four times its single channel power into a single load. It uses just one economy integrated circuit and a few other components.

Specifications

Input Impedance	220K Ohm
Output Impedance	less than 1K Ohm
Gain	unity
Maximum input and output	greater than 8V RMS
Frequency response	10Hz to 300kHz +/- 1 dB
Harmonic Distortion	less than .001% @ 8V RMS
Signal/noise ratio	-104dB with respect to 1V RMS and with 1K Ohm source impedance

K 5565 **$15.95**

Full connection details supplied with the kit.

Sub-Woofer Adaptor

(See EA May '89)

Get an amazing bass improvement from your stereo system.
This fantastic adaptor simply "samples" your stereo amp output and provides a single channel output to feed a separate sub-woofer amp. Unwanted audio spectrum is removed with the Frequency Control (cut-off threshold adjustable 60-130Hz). Also includes an "out of phase" output enabling the use of stereo amp in a bridge configuration for those who really want to rattle the floorboards.

K 5560 (Less Adaptor) **$29.95**

M 9020 (12V AC Adaptor) $16.95

Active Subwoofer Project

For those of us who have "bookshelf" speakers or a budget or compact speaker system with limited bass performance — this project will provide a quite amazing improvement to your stereo system.

Simple to Connect. This active subwoofer is fully self contained with its own amplifier, power supply and loudspeaker drivers. Simply connect two light duty "fig 8" cables to your stereo system amplifiers output speaker terminals to the corresponding subwoofer input terminals. The subwoofer amplifier can be powered by any convenient 240V power outlet in the room. **Note** as low frequency "bass" notes are largely non directional this subwoofer unit can be placed anywhere in the room; out of sight behind furniture, in a corner out of the way etc. Even so you'd swear that your wonderful new found bass notes emanate from your primary speaker source.

This kit comprises: 100 watt amplifier with input combiner/filter circuit, two high grade emulsion cone 6½" bass drivers and an optional speaker cabinet.

The input circuit alternates the stereo amplifier output signal, combines left and right to a single channel, a variable low pass filter removes the unwanted frequency spectrum (typically above 100Hz - 200Hz).

A preset gain control is included to balance the low register volume to the primary speaker system sound level.

Provides fantastic Bass enhancement for your stereo system.

Auto Power Up/Down: The subwoofer input circuitry senses whether the primary stereo amplifier power is on and powers up automatically. The subwoofer will power down after approx. 30 minutes if no audio signal is present on the primary amplifier speaker lines.

Bass Drivers: Two of Redford 6½" high performance PECC bass drivers are supplied with the kit. Full specifications of these are provided in our '91 catalogue.

Kit Less Cabinet K 5000 **$349.00**

Full cabinet construction details provided free on request.

Active Direct Injection Box

(See EA Oct'87)

Converts high impedance unbalanced inputs to low impedance balanced outputs. Used in studios, music, PA industry to convert high impedance devices i.e. electric guitar pickups, synthesizer etc. to low level balanced outputs to be fed over long lines. This is done to prevent hum pickup.

FEATURES:

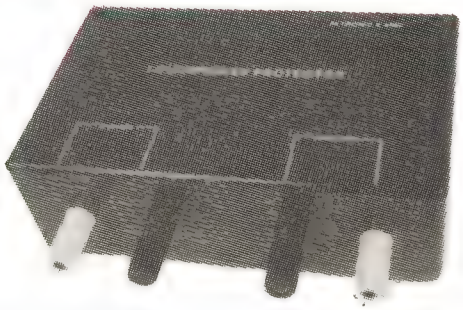
- Sturdy diecast box
- Black tough indust. powder coat finish
- Professionally screen printed
- Earth isolate switch
- +5db pad
- Phantom powering plus internal 9V bat.

K 5550 **$45.00**

Speaker Protection Kit

(See ETI Oct'82)

Cheap Insurance for that $1000 Speaker System



Protect your valuable loudspeaker system with this easy to build kit. Based on the ETI design (Oct'82) provides both DC and overpower protection for your valuable Hi-Fi speakers. Self-powered unit disconnects the speakers within 1/10th of a second of a fault occurring yet in no way affects the sound quality. Just connects into speaker line. Install it in minutes - No AC or DC connections required - 2 required for stereo

K 5051 **$35.00**

PHONEORDER TOLL FREE 008 999 007

KITS

Got a CD? This new "compander" or Dynamic range compressor is just the shot for recording to tape and for use with PA systems etc.

Stereo Dynamic Range Compressor

(SC March'89)

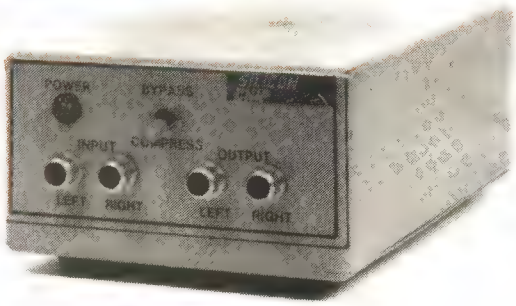
CD's are naturally enough being used in countless background (and foreground) music installations - from boutiques, coffee shops, clubs, restaurants, bars and offices etc. Now comes the problem — the audio level track to track can vary considerably. This is especially annoying with multi-disc CD machines selected to "random" track selection i.e. one is continually adjusting the amp volume control for an acceptable sound level. Now comes the solution, the Silicon Chip CD Compressor.

This brilliant design enables wide dynamic range CD's to be either recorded on standard tape or played into background music keeping the sound level within an acceptable range.

Compressed music is easier to listen to in noisy environments such as a car or bar etc.

The high levels are attenuated while the lows are amplified — thus limiting the dynamic range.

Ultra low distortion.



K 5580 **$49.95**

240V/12V Ac Plug Pack M 9020 **$16.95**

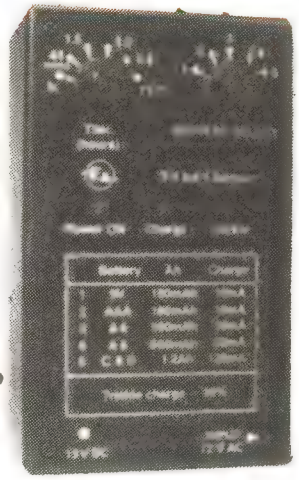
Automatic Charger for NiCads

(See EA July '89)

Get 100's more recharge cycles from your nicads

Its now well known that correctly charging nicad cells greatly extends their service life.

Here is a fully automatic NiCad battery charger that enables differing charge rates as appropriate for AAA, AA, C, D cells or cells in series up to 9V. Once the battery is charged, the unit automatically switches to trickle charge until you switch it off. It is fully featured, yet surprisingly simple.



FEATURES:

- Low cost and simple to construct
- Fully punched and screened case.
- Variable charge rate.
- Variable timer.
- Flexible and simple to use.
- Visual display of charge mode.
- Nicads cannot be over charged.

K 1650 $39.50

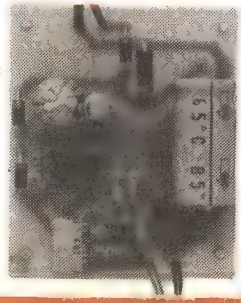
M 9020 (Plug-Pack Extra) $16.95

Solar Generator

(See ETI Dec '87)

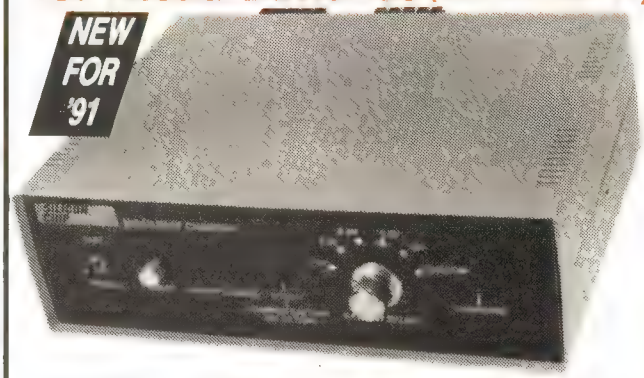
Charge Your Batteries Free From the Sun

The Solar Generator charges and maintains your standard 12V lead acid car battery via the sun. Fantastic for maintaining batteries which are not used or checked frequently. Ideal for boats, caravans and remote data acquisition stations etc. Note: Must be used in conjunction with a suitable solar panel.



K 1680 $13.95

High Capacity Fast Charger for Nicad Batteries (SEE SC Jan '91)



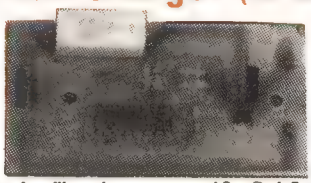
This charger is designed to operate from a 12V battery. It can charge nicad battery packs from 6-12V at up to 6A, or you custom wire the circuit to charge battery packs up to 30V at a reduced current.

In operation the circuit will recharge a typical nicad racing pack in about 20 minutes.

FEATURES: • Fast charge rate • Switch selectable voltage setting in 1.2V steps from 6V-12V • Fully punched and screened front panel • State of the art digital circuitry

K 1660 $129.00

12V Gel Cell Charger (SC July '89)



This simple circuit will recharge your 12v Gel Cells correctly, increasing their life span. Kit consists of 1 IC and a handful of external components plus the PCB. Charging current and voltage is controlled and over-charging is avoided by the IC switching off when the cell is fully charged.

FEATURES:

- Extends life of Gel Cells
- Automatic charge rate
- Simple to construct
- 15V DC - 24V DC input

NEW IMPROVED CIRCUIT

K 1685 $23.50

PHONEORDER TOLL FREE 008 999 007

EA Drill Speed Controller MK2

For universal brush type motor drawing up to 3Amps.

Varies motor speed from a few RPM to full speed while maintaining good torque.

Suitable for:

- Drills and drill presses
- Circular saws
- Jig saws
- Food mixers
- Movie projectors

Altronics kit comes complete with mains flex lead and plug plus quality "ABS" Jiffy Box, pre-punched and screened panel

(See EA Dec '84)

K 6005 $29.50

Touch Lamp Dimmer

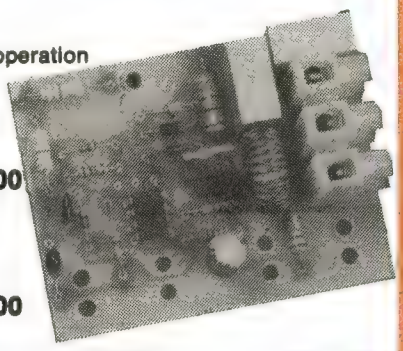
(See SC June '89)

Impress your next dinner guests with this nifty "Touch" Lamp Dimmer

Are you still persisting with one of those old knob type Light Dimmers? Well here is a light dimmer which can turn your lights on and off or just dim them by touching the decorative plate.

FEATURES:

- Easy to install
- Extremely safe operation



Supplied With Gold Touch Plate

K 6329 $35.00

Supplied With Silver Touch Plate

K 6330 $35.00

Beat Triggered Strobe

(See AEM July'85)

Add Some Life To Your Next Party

K 5790 $79.95

For Increased Power Two Tube Option K 5795 $16.50

Designed by Australian Electronics Monthly. Flashes in time to your music. Will also work as normal strobe. Exclusively customised by Altronics into our H 0480 Instrument Case, making construction a breeze and improving stability and overall appearance. Includes silk screened panel.

Discolite (See SC July/Aug'88)

Add Some Colour To Your Next Party. Great For Parties, Shop Displays and Special Lighting Effects

The Discolite flashes party lights on & off in beat with music from your amplifier. ● 4 light channels controlled by 4 separate audio channels. ● Forward reverse & auto-reversing chaser patterns. ● Simultaneous strobe on all four channels. ● Alternating light patterns. ● Music modulation available on chaser strobe & alternate patterns. ● Inbuilt microphone for beat triggering or audio modulation of lights. ● Direct inputs for beat triggering or audio modulation of lights. ● Sensitivity control. ● Presettable sensitivity levels for each channel. ● Front panel LEDs mimic light display ● Altronics Kit pre-punched & silk screened.

K 5805 $159.50

Video Enhancer

(See EA Oct '83)

Sharpens up your picture when copying video to video

Here's a simple but effective video enhancer that is super easy to build at a fraction of the cost of commercial models.
Unit sharpens picture detail, and can actually improve the quality of a copy by amplifying the top end of the video signal.

SPECIFICATIONS:

- Signal to noise ratio 50db ref. 1V p-p
- Frequency response (flat): 1 Hz to 6.5MHz - 3db
- Boost and cut plus and minus 6.3db
- Gain 0db
- Input impedance 68 Ohms

Complete kit supplied with silk screened front panel

K 5825 $42.50

Video Amplifier

(See EA Aug'83)

Another first class project from EA. Super cheap and super effective. For computers with low video output e.g. "Taiwan Apples", etc.

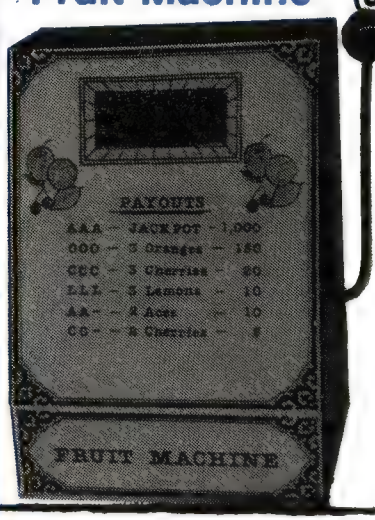
This video amp can greatly improve picture stability and eradicate shimmer, screen swim etc. Two outputs, normal and inverted. Ideal for VCR users. Tired of a grainy or snowy picture? Connect this amp internally to your TV and presto, the improvement is fantastic! (Documentation is quite detailed on connection to TV sets)

K 5850 $17.50

PHONEORDER TOLL FREE 008 999 007

KITS

Fruit Machine (See SC Jan '91)



Enjoy the fruits of your labour. Build the flavoursome Fruit Machine.

This novel kit works just like a real poker machine but without the expense of losing money. It has a jackpot and five other winning combinations.

It is a good exercise in electronic principles using timers, counters and decoders.

K 1160 $49.50

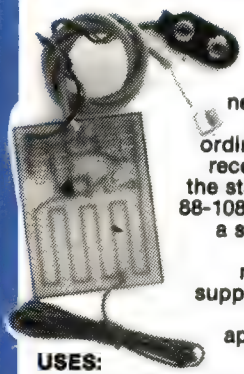
Less Cabinet

Electronic Die (See SC July '90)

How many times have you opened up that favourite board game to find that someone has pinched the dice? In that case, why not build this electronic die which uses just two CMOS IC's? It simulates the roll of a real die and even turns itself off.

K 1140 $29.50

FM Radio Microphone



This simple FM Microphone Kit can be built in next to no time and only requires an ordinary FM Radio for reception. • Works in the standard FM Range 88-108MHz • Runs from a single 9V battery • High sensitivity microphone insert supplied • Long range transmission approximately 30M.

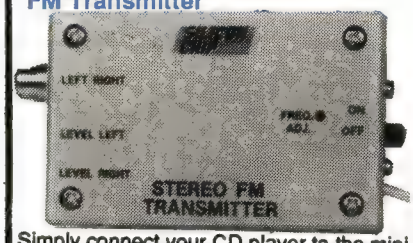
USES:
• Wireless Microphone
• Professional Eavesdropping • Listen to the TV in the kitchen • Makes an excellent child minder • Could be adapted to an alarm e.g. send a tone to your clock radio when your car alarm trips.

K 1106 $11.50

FM Stereo Transmitter (Mini Mitter)

(See SC Oct'88)

Turn Your CD Player Into A Mini FM Transmitter



Simply connect your CD player to the mini mitter which converts the CD signal to an FM signal. This FM signal then can be tuned in via your FM walkman or your shed radio. Great for listening to your favourite CD while washing the car, mowing the lawn or doing the vacuuming etc., without blasting the neighbours. Powered by single 1.5V penlite battery. Single IC circuit. Simple to build and construct.

K 1120 $43.50

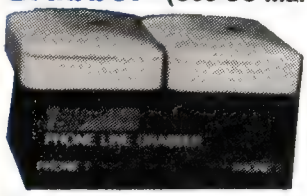
Utility Timer (See Mar '88)

Time your STD calls and save money.

This simple timer has a multitude of uses, from cooking your eggs to timing telephone calls. Timing is adjustable from 10 seconds to 15 minutes. It features a ten way count down LED display. As time elapses the LED's progressively light up and the buzzer sounds momentarily. At the end of the cycle the buzzer sounds for a longer period. Altronics Kit includes silk screened front panel.

K 1425 $28.50

Telephone Line Grabber (See SC Mar'88)



The Telephone Line Grabber has been designed to prevent interruption from one extension to another. When one extension is being used it automatically mutes the other extension (s). This allows complete security for your call - no more interruptions from the kids lifting & listening in. No more accidental overdialing. Also great for use with modems. One unit required for each extension.

K 1415 $19.95

Telephone Off Hook Indicator (See SC Nov'87)

Use where 2 or 3 phones are connected on one line. If one extension is in use a LED will flash in each of the other extensions. Requires no external supply. Runs off the telephone line. One module required for each phone.

K 1400 $9.95

Watch our monthly advertising in E.A. and S.C. for new kits throughout 1991.

PHONEORDER TOLL FREE 008 999 007

VIFA SA-50 2-Way Speaker Kit

C 3250

$399.00PR

No longer are big, ugly looking boxes of the size of refrigerators necessary to fill your lounge with sound. A new specially developed 5" woofer/ midrange from VIFA has been computer optimized for use in a 5 litre bass reflex cabinet. Flushmounted in the front baffle the woofer blends perfectly with the classic 95mm VIFA dome tweeter with ferro fluid for higher power handling and perfect control of the diaphragms movements. The SA-50 has its bass reflex port mounted at the rear, which makes this speaker ideal for bookshelf mounting. A distance of 5-10cm to the wall will provide the optimal bass performance. The compact size of these speakers, will make it possible to blend them in with any decor, without cluttering the room up. One of the many benefits of small speakers is their stereo imaging. Due to the small surface of the front baffle, reflections are very limited, resulting in better stereo pictures than can be achieved from large speakers. Complete kit includes crossovers and cabinets.

VIFA SA-100 2-Way Speaker Kit

C 3270

$799.00PR

(Stands not included)

This exciting new high-performance speaker kit uses VIFA drivers from Denmark. It is an improved version of the original David Tilbrook design AEM—6102 speaker kit. A new advanced crossover design with asymmetrical crossover slopes and impedance correction circuit give these speakers an unequalled performance with any fully-imported loudspeaker system under $2,000 a pair. Well over 2000 of the original AEM—6102 speaker systems have now been built in Australia with superb results. With a saving well in excess of $1,000 compared to any fully-imported loudspeaker system, it is now your amplifier and the rest of your ancillary equipment that sets the limit for your enjoyment of your hi fi system. The speaker kits consist of the famous 8" polycone woofer with diecast chassis and rubber roll surround. The tweeters are the legendary D25 tweeter with ferro-fluid cooling and polymer diaphragms. The cabinet is supplied in knock-down form veneered in beautiful black woodgrain look with silver front baffles, speaker cloth, damping material, grill clips, speaker terminals, screws and ports. The performance of these speakers is outstanding. Australian Hi Fi magazine recently acclaimed: "Well, Mr Tilbrook and Scan have certainly done their homework. The AEM-6102 is simply superb. A very accurate design and exhibits remarkably low levels of colouration and distortion - across the board". Complete kit with speakers, crossovers and cabinets.

VIFA SA-70 2-Way Speaker Kit

C 3260

$499.00PR

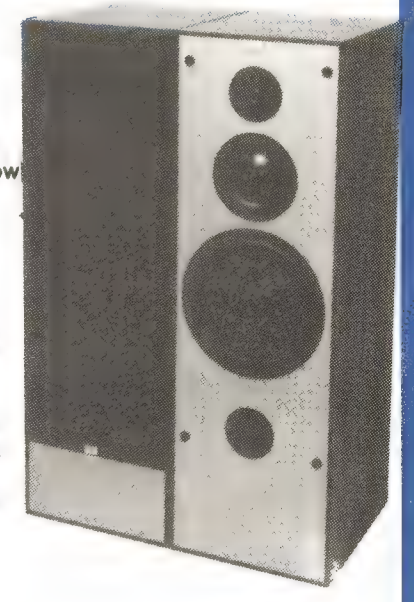
The new SA-70 is an improved version of the original EA-60/60 speaker kits released in Electronics Australia magazine. Over 2,500 of these speakers have been built since their release and they have become one of the most popular bookshelf speakers in Australia.

Anybody can build these speakers - no carpentry skill or electronics certificate is needed. Some extracts from EA magazine:"The tweeters are exotic little beasties" (Editor EA magazine). It is the all-time popular 19mm soft dome tweeter with ferro-fluid damped voice coil and very smooth frequency response. The woofers are a new improved 8" sandwich-coated woofer with foam surround. A new crossover design extracts all the performance out of these esoteric Danish loudspeaker drivers. The power handling is increased to 70 watts RMS per channel, and in an average size lounge room driven by a 20-80 watts amplifier these speakers will reproduce all kinds of music with the highest fidelity.Complete kit of speakers, crossovers and cabinets.

VIFA SA-130 3-Way Speaker Kit

C 3280

$1,199.00PR



The large floorstanding top-model AEM—6103, originally designed by David Tilbrook, has since been improved, & is now available in a new slimmer cabinet, with improved drivers & the latest European crossover technology. With a dispersion pattern linear up to 120° these new SA-130 are to be ranked among the finest imported speakers in the 2500-3000 dollar bracket. The tight deep bass is produced by the powerful 10" Polycone woofer P25WO, which has diecast magnesium basket, aluminium voicecoil former and rubber roll surround. The new improved 3" dome midrange D75MX takes care of the critical midrange area, giving these speakers a most accurate and neutral performance, especially notable on human voices, which are reproduced with the highest fidelity. A classic among dometweeters is the brilliant 19mm ferro fluid cooled D19TD. Have a close look at all the imported English and European loudspeaker systems and you will find this little star in almost half of them. Not without reason! Its polymer diaphragm provides extremely clear and well balanced treble.

The new VIFA SA-130 top-model is supplied in kit form, with flat-pack cabinets, finished in nice black woodgrain..

PHONEORDER TOLL FREE 008 999 007

vifa SPEAK High Performance Loudspeaker Components

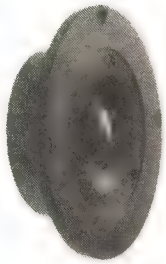
TWEETERS

VIFA D 19TD-05-08
19mm dome tweeter with polymer diaphragm. This dome tweeter is VIFA's biggest selling driver. Very smooth and versatile. Ferro fluid cooled voice coil ensures high power handling & perfect damping. Suited for any quality 2, 3, & 4 way system with power handling up to 100 Watts RMS.

C 3150 **$45**ea

VIFA D25TG-55-06
25mm dome tweeter with polymer diaphragm. Larger and more powerful version of the D19TD. Smooth and detailed performance with low colouration. Ferro fluid cooled voice coil makes this tweeter suited for high powered 2 & 3 way systems up to 150 Watts RMS.

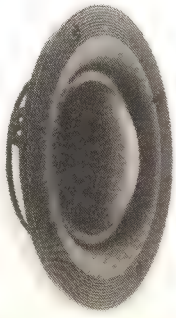
C 3155 **$74**ea



MIDRANGES

VIFA K10MD-18-08
4" sandwich coated cone midrange with foam surround. High quality midrange for any 3 way system. Accurate & neutral performance with low colouration. Requires a 0.5 litre sealed & damped enclosure (e.g. VIFA's PC-K10 plastic cover). Ideal for systems up to 80 Watts RMS.

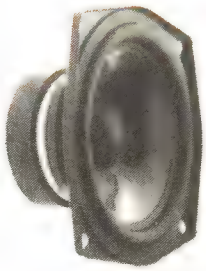
C 3135 **$79**ea



VIFA D75MX-22-08
Unusual 3" dome midrange with a coated soft textile diaphragm. Very smooth & detailed performance with excellent dispersion & clarity. 75mm voice coil ensures high power handling & superb transient response. Requires a 1.5L sealed & damped enclosure (e.g. VIFA's CC-D75 cover). Optimal midrange in 3 & 4 way systems with a power handling up to 150 Watts RMS.

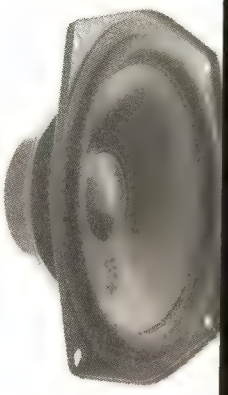
C 3140 **$129**ea

WOOFERS



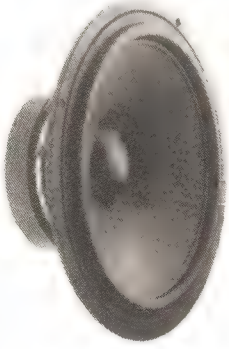
VIFA C13WG-08-08
5" sandwich coated woofer with rubber surround. High performance driver which can be used in 3 way, 15 litre bass reflex or sealed enclosures. Very smooth response useful up to 5KHz, & 50 Watts RMS power handling capacity.

C 3110 **$99**ea



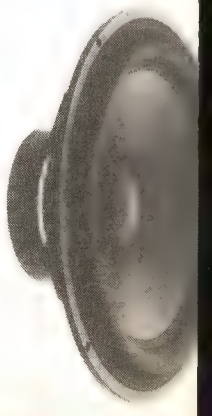
VIFA C20WG-09-08
8" sandwich coated woofer with foam surround. One of VIFA's most successful drivers. For use in 10-15 litre sealed enclosures. Very flat response with low distortion. Ideal in 2 way bookshelf systems. 50 Watts RMS power handling.

C 3120 **$119**ea



VIFA P21WO-12-08
8" polycone woofer with large magnet & diecast magnesium basket for highest rigidity. This woofer has rubber surround. Can be used in 25-45 litre bass reflex enclosure. Ideal in both 2 & 3 way systems. 70 Watts RMS power handling capacity.

C 3125 **$188**ea



VIFA P25WO-00-08
This 10" polycone woofer is the largest in the Polycone range. Large magnet, diecast magnesium basket & rubber surround. Designed for 3 way bass reflex systems with a volume of 50-100 litres. 75 Watts RMS power handling capacity.

C 3130 **$220**ea

PHONEORDER TOLL FREE 008 999 007

High Quality At Low Cost

Most of the "state-of-the-art" high performance speaker systems (especially the European ones) use either bextrene or polypropylene cone material in their woofers. This development, as well as system designs based on Theile/Small parameters, has yielded significant improvement in bottom-end frequency response performance & cabinet size reductions for a given level of performance. The lightweight plastic cones offer levels of performance above that of conventional cardboard cones which have been around since loudspeakers were first made. The cone is more rigid and does not "break-up" (flex) as much as its counterparts.

6 1/2" Midrange

30 Watts RMS 50W Max.

With Sealed Frame
Rated Power Input 30W
Max. Power Input. 50W
Impedance (400Hz) .... 8 Ohm
Frequency Response... fo-6kHz
Resonant Frequency .. 400Hz (+/-80Hz)
Sensitivity 98dB/W (0.5m)
Voice Coil. 25mm
Nett Weight 770gm
Magnet ..... 263gm/10 oz

C 3045 $27.50

6 1/2" Woofer/Midrange

30 Watts RMS 50W Max.

Rated Power Input 30W
Max.Power Input 50W
Impedance (400Hz) .... 8 Ohm
Frequency Response .. fo—4kHz
Resonant Frequency .. 40Hz(+/-12Hz)
Sensitivity 96dB (0.5m)
Voice Coil 25mm
Nett Weight 740gm
Magnet 283gm/10oz

C 3055 $29.95

8" Woofer

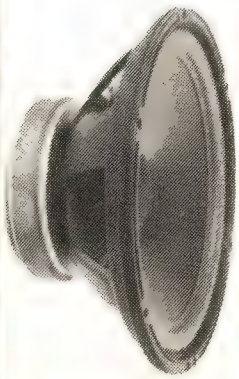
60 Watts RMS 100W Max.

Rated Input Power 60W
Max. Input Power 100W
Impedance (300Hz) .... 8 Ohm
Frequency Response .. fo—4kHz
Resonant Frequency .. 35Hz(+/-7Hz)
Sensitivity 97dB/W (0.5m)
Voice Coil 39mm
Nett Weight 2150gm
Magnet 848gm/30oz

C 3060 $54.95

10" Woofer

60 Watts RMS 100W Max.

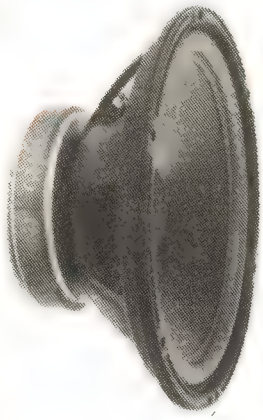


Rated Input Power 60W
Max.Input Power. 100W
Impedance(200Hz) ..... 8 Ohm
Frequency Response .. fo—4kHz
Resonant Frequency .. 45Hz(+/-9Hz)
Sensitivity ..... 98dB/W(0.5m)
Voice Coil 38mm
Nett Weight 2350gm
Magnet 848gm/30oz

C 3065 $69.00

12" Woofer

100Watts RMS 150W Max.

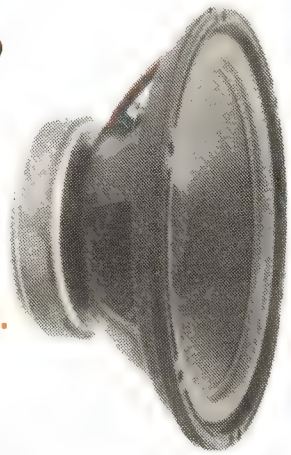


Rated Input Power 100W
Max.Input Power 150W
Impedance (200Hz) .... 8 Ohm
Frequency Response.....fo—3kHz
Resonant Frequency .. 30Hz(+/-6Hz)
Sensitivity 98dB/W (0.5m)
Voice Coil 38mm
Nett Weight 2500gm
Magnet 848gm/30oz

C 3070 $99.00

15" Woofer

120 Watts RMS 200W Max.



Rated Input Power 120W
Max. Input Power 200W
Impedance(200Hz) ..... 8 Ohm
Frequency Response.....fo—15KHz
Resonant Frequency .. 25Hz(+/-5Hz)
Sensitivity 98dB/W (0.5m)
Nett Weight..... 4000gm
Voice Coil 50mm
Magnet 1420gm/50oz

C 3075 $129.00

12" Guitar Speaker

150 Watts RMS 200W Max.

Rated Input Power 150W
Max.Power Input 200W
Impedance(300Hz) ..... 8 Ohms
Frequency Response.....fo—5kHz
Resonant Frequency.... 40Hz
Sensitivity ..... 94dB/W0.5m)
Voice Coil 50mm
Nett Weight 4000gm
Magnet 1420gm/50oz

C 3100 $160.00

PHONEORDER TOLL FREE 008 999 007

Redford High End Poly Emulsion Coated Cone Woofers at Direct Import Prices

Altronic Distributors announces the release of a new generation of high end woofers. The development of high grade driver components in Japan, such as Barium ferrite magnets and specially formulated paper cones impregnated with poly emulsion, have enabled us to offer our customers drivers of quite remarkable power handling, performance and extremely low distortion.

We believe the performance exceeds that obtainable from many European "name" brands; and the direct import prices from Altronics compare favourably with the considerably inferior standard cone varieties offered by our competitors.

Cone Materials. This series of loudspeaker features a specially selected fibre impregnated paper cone which is coated with a layer of polypropylene to add the desired rigidity. An added benefit of this coating is its resistance to water and moisture ingress.

Voice Coil Construction. All voice coils are wound on aluminium. The magnet pole pieces are vented for heat dissipation. Bump back plates are employed to allow extra voice coil excursion.

6½" PECC Woofer
30 Watts RMS 60W Max.

Rated Input Power	40W
Max. Input Power	60W
Impedance (400Hz)	8ohm
Frequency Response	FO-5kHz
Resonant Frequency	70Hz (+/-14Hz)
Sensitivity	96dB/W(0.5m)
Nett Weight	1680gm
Magnet	567gm/20oz
Revc (ohm)	6.8
Qms	1.90
Qes	0.44
Qts	0.36
Mmd (G)	12.3
Cms (um/N)	538
Vas (L)	9.5
Sd (mm²)	11231

C 3022 $49.95

10" PECC Woofer
80 Watts RMS 130W Max.

Rated Input Power	80W
Max. Input Power	130W
Impedance (400Hz)	8ohm
Frequency Response	FO-4kHz
Resonant Frequency	28Hz (+/-5Hz)
Sensitivity	97dB/W(0.5m)
Nett Weight	4020gm
Magnet	1170gm/41oz
Revc (ohm)	6.8
Qms	1.20
Qes	0.24
Qts	0.20
Mmd (G)	61.3
Cms (um/N)	527
Vas (L)	84.1
Sd (mm²)	33772

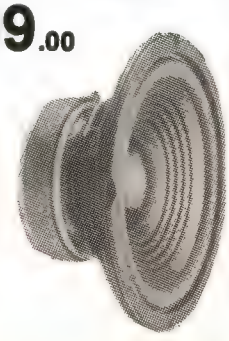
C 3026 $99.95

NEW IN '91

8" PECC Woofer
60 Watts RMS 100W Max.

Rated Input Power	60W
Max. Input Power	100W
Impedance (300Hz)	8ohm
Frequency Response	FO-4kHz
Resonant Frequency	60Hz (+/-12Hz)
Sensitivity	98dB/W(0.5m)
Nett Weight	2600gm
Magnet	848gm/30oz
Revc (ohm)	6.8
Qms	1.81
Qes	0.38
Qts	0.31
Mmd (G)	20.1
Cms (um/N)	525
Vas (L)	27.8
Sd (mm²)	19438

C 3024 $69.00



12" PECC Woofer
80 Watts RMS 160W Max.

Rated Input Power	80W
Max. Input Power	160W
Impedance (300Hz)	8ohm
Frequency Response	FO-3kHz
Resonant Frequency	25Hz (+/-5Hz)
Sensitivity	98dB/W(0.5m)
Nett Weight	4810gm
Magnet	1408gm/50oz
Revc (ohm)	6.8
Qms	1.38
Qes	0.30
Qts	0.25
Mmd (G)	43.1
Cms (um/N)	1020
Vas (L)	360
Sd (mm²)	50069

C 3030 $125.00

15" PECC Woofer
100 Watts RMS 200W Max.

Rated Input Power	100W
Max. Input Power	200W
Impedance (400Hz)	8ohm
Frequency Response	FO-3kHz
Resonant Frequency	25Hz (+/-5Hz
Sensitivity	98dB/W(0.5m
Nett Weight	5910gm
Magnet	1835gm/65oz
Revc (ohm)	6.8
Qms	2.31
Qes	0.38
Qts	0.33
Mmd (G)	86.4
Cms (um/N)	434
Vas (L)	500
Sd (mm²)	90713

C 3032 $198.00

DIRECT IMPORT PRICE

PHONEORDER TOLL FREE 008 999 007

Redford Woven Carbon Fibre Woofer/Midrange Loudspeakers

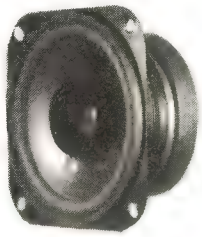
Built from the latest technology in magnets, voice coils and carbon fibre cone material these drivers exhibit quite outstanding reproduction from the low frequency register through to quite remarkable mid range performance. Using top quality Japanese materials they are definitely not cheap, however we guarantee any suitably designed enclosure/crossover system will offer a considerable saving over the cost of commercially available name brand speaker systems.

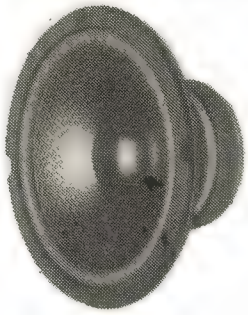
This Redford line of speaker products incorporates many unique design features. Some feature highlights include:

1. Carbon Fiber Cone — This lightweight yet rigid material greatly reduces cone breakup — which is the major reason for bass response distortion at higher volume levels. Musically, carbon fiber reproduces sound with a much smoother frequency response.

2. Voice Coils — This is the hardest working part of a speaker. Not only does it have to vibrate at up to several thousand times a second — it must also withstand severe high temperatures. It is with this in mind that Redford woofers feature the revolutionary Kapton voice coil. This material can dissipate heat much better than conventionally used voice coil materials.

3. Magnets — Each magnet size and weight has been carefully matched to the desired specification. We use heavy duty strontium ferrite or barrium ferrite magnet materials and extra thick front and back plates for this woofer series to create a strong magnetic field for the high power demands of todays audio system.





NEW FOR '91

4" Carbon Fibre Dual Cone Wide Range Speakers

Rated Input Power	15W
Max. Input Power	25W
Impedance	8 Ohm C 0642
(at 600Hz)	6 Ohm C 0643
Freq. Response	FO-20kHz
Resonant Frequencey	110Hz (+/-10Hz)
Sensitivity	96dB/W (05m)
Nett Weight	580gm
Magnet	226gm/8.0oz

	C 0642	C 0643
Revc (ohm)	7.3	14.5
Qmx	4.52	4.64
Qex	.6897	.8905
Qtx	.5983	.7472
Mmd (G)	2.42	2.44
Cms (um/N)	860	870
Vas (L)	3.89	3.92
Sd (mm²)	5700	5700

C 0642 8 Ohm
C 0643 16 Ohm $39.95

6½" Carbon Fibre Woofer 30 Watts RMS 70W Max.

Rated Input Power	30W
Max. Input Power	70W
Impedance (300Hz)	8ohm
Frequency Response	FO-6kHz
Resonant Frequency	65Hz (+/-13Hz)
Sensitivity	97dB/W(0.5m)
Nett Weight	1700gm
Magnet	567gm/20oz
Revc (ohm)	6.8
Qms	3.99
Qes	0.43
Qts	0.39
Mmd (G)	18.6
Cms (um/N)	313
Vas (L)	6.0
Sd (mm²)	11663

C 3034 $69.95

8" Carbon Fibre Woofer 60 Watts RMS 100W Max.

Rated Input Power	60W
Max. Input Power	100W
Impedance (400Hz)	8ohm
Frequency Response	FO-5kHz
Resonant Frequency	50Hz (+/-10Hz)
Sensitivity	98dB/W(0.5m)
Nett Weight	2600gm
Magnet	848gm/30oz
Revc (ohm)	6.8
Qms	4.11
Qes	0.32
Qts	0.30
Mmd (G)	28
Cms (um/N)	492
Vas (L)	27.6
Sd (mm²)	20027

C 3036 $89.95

10 Watt Megaphone PA

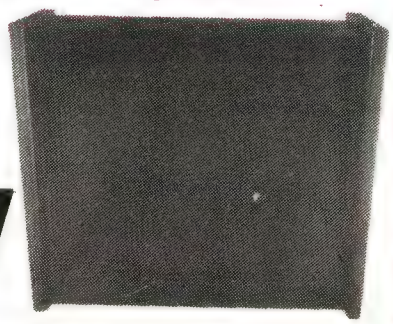
Range: 300M approx. (up to 800M in ideal conditions)
Power: 8 x AA cells not supplied (order separately 2 of Altronics S 4920)

A 1980 $129.00

Wall Mount Speakers

Great for PA Systems or as extension speakers for the back patio. Attractive black cloth with Jarrah look timber sides.

PROUDLY MADE IN AUSTRALIA



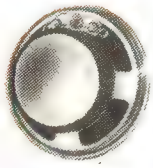
- Box Enclosure **C 0900 $33.95**
- Fitted with 8" 8 ohm 10W Dual cone speaker (ideal Hi-Fi extension) **C 0910 $44.95**
- Fitted with 8" dual cone speaker and 5W 100V Line Transformer (suited PA/BGM System) **C 0920 $52.95**
- Fitted with 8" dual cone speaker, 5W 100V Line Transformer and Volume Control **C 0922 $59.95**

PHONEORDER TOLL FREE 008 999 007

QUALITY SPEAKERS AT LOW COST

LOUDSPEAKERS

Quality Replacement Speakers



C 0610 **$2.30** 10 Up **$1.75**

Mini
57mm 250 mW 8 Ohm
Large ferrite magnet

C 0612 **$6.50** 10 Up **$5.95**

Mini Speaker
82.5mm (3 1/4") 3 Watt 8 Ohm
Mounting holes at 71mm centres.

C 0616 **$6.50** 10 Up **$5.95**

100mm (4")
Dual Z 4/8 Ohm 3Watt RMS.
Mounting hole centres at 82mm.

C 0618 **$7.95** 10 Up **$7.25**

125mm (5")
Dual Z 4/8 Ohm 3 Watt RMS.
Mounting hole centres at 85mm.

C 0620 **$8.95** 10 Up **$7.95**

165mm (6 1/2")
Dual Z 4/8 Ohm 3 Watt RMS
Mounting holes at 112mm centres.

C 0622 **$9.95** 10 Up **$9.50**

150 x 100 (6" x 4")
Dual Z 4/8 Ohm 3Watt RMS.
Mounting hole centres 57 x 146mm.

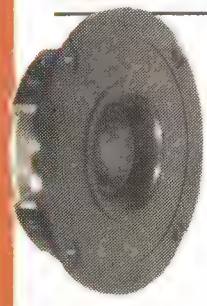
C 0624 **$12.50** 10 Up **$11.20**

178 x 125 (7" x 5")
Dual Z 4/8 Ohm 3 Watt RMS
Mounting hole centres 110 x 110mm

C 2000 **$16.50** 10 Up **$15.00**

Dual Cone (8")
200mm (8") 10 Watts max. power input.
Public address background music. Ideal HiFi extension speaker. Includes transformer holes at 51mm, mounting holes at 198mm centres.

Tweeters



Dome Tweeter With Ferro Fluid
60 Watt Max. Power
Silky smooth frequency response 1.5Hz to 20 kHz. Wide angle dispersion. Massive power handling capacity. Diam. 94mm. High spectrum. Purity. Incredible low price!

C 3012 **$29.50**

4 up **$27.00**

ECONOMY DOME TWEETER

Tweeter with polymer diaphragm. Very smooth clean response to 200kHz. High power handling and excellent damping. Use with speaker systems to 50 Watts.

C 3010 **$15.00** 4 Up **$14.00**

(See page 20 for details on Vifa Tweeters)

High Performance Wide Range Speakers

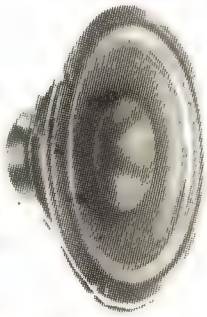
100mm (4") 15 Watt
High efficiency dual cone quality driver. Excellent midrange "presence". Roll edge cone suspension.

PA SYSTEM APPLICATIONS
C 0626 8 ohms **$17.50** 10 Up **16.00**

MUSIC APPLICATIONS
C 0628 8 ohms **$17.50** 10 up **$16.00**

125mm (5") 15 Watt
High efficiency dual cone quality driver. Excellent midrange "presence". Roll edge cone suspension. Used with the Redford weatherproof sound column range. Mounting holes at 120mm centres. 16 Ohms.

C 0632 16 ohm **$19.50** 10 Up **$18.00**



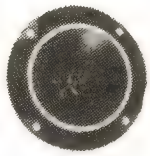
200mm (8") 30 Watt
Roll edge suspended cone. High midrange efficiency especially suited to use in vocal PA and sound column use. Superbly smooth high power speaker. Max. input power 30W 8 Ohm Z. Resonant Freq. 60Hz. Mounting holes at 198mm centres.

C 2001 **$24.50** 10 Up **$23.00**

Piezo Ceramic Speakers

Piezo Ceramic Speakers offer several advantages over conventional speakers, such as -

- No bulky magnet structure
- No voice coil
- No crossover network required
- Excellent transient response
- Extremely low distortion
- High impedance as Piezo appears as capacitive rather than inductive load
- Light weight
- High power capability.



Round Tweeter
95.3mm Diam. Piezo Speaker. Suitable for Hi Fi applications. **Freq.Res.** 3K to 40KHz **Sens:** 104db @ 2.8V

C 6100 **$19.50** 4 Up **$17.00**

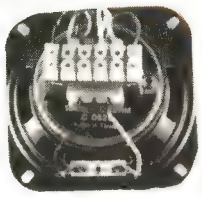
Rectangular Hi Fi-PA Piezo
144.8 x 54mm Rectangular Piezo Horn Speaker - suitable for Hi Fi and Sound Reinforcement. Full 90 deg. horizontal dispersion angle. **Freq.Res:** 3K to 40KHz **Sens:** 110db @ 2.8V.

C 6120 **$19.50** 4 Up **$17.00**

Motorola KSN 1141A
177.8 x 82.6mm Rectangular Piezo horn speaker suited to Hi Fi and PA and sound reinforcement. Incorporates special audio protection circuit to enable speaker to handle 400W continuous power, and also makes it "Blow up Proof".90 deg. Dispersion Angle.**Freq.Res.** 1.9K to 40KHz **Sens:** 100db @ 2.8V

C 6150 **$39.95** 4 Up **$37.50**

PHONEORDER TOLL FREE 008 999 007



PA Speakers with 100V line Transformers

These quality Redford dual cone loudspeaker and transformer combinations are now the "Industry Standard" throughout Australia. The 100mm (4in) and 200mm (8in) drivers incorporate TDK magnets and a special composition cone material. The transformers are wound on high quality silicon steel.

The resultant reproduction and sound pressure level of each of these speaker units is of a high standard.

TWO TRANSFORMER STYLES AVAILABLE:

M1106 type transformer: Primary taps .33W (32kohm), .66W (16kohm), 1.25W (8kohm), 2.5W (4kohm), 5W (2kohm). Six way screwdrivers terminal block fitted.

M1109 type transformer: Primary taps .5W (20kohm), 1W (10kohm), 2W (5kohm), 5W (2kohm). Three way terminal block provided (normally terminated to common. 1W and 2W taps). Both transformers have 8ohm secondaries.

FOR PUBLIC ADDRESS AND BACKGROUND MUSIC INSTALLATIONS

C2100 100mm with M1106 **$27.50** 10 up **$26.00**

C2102 100mm with M1109 **$24.50** 10 up **$22.50**

C2106 200mm with M1106 **$27.50** 10up **$26.00**

C2108 200mm with M1109 **$24.50** 10up **$22.50**

FOR FIRE EVACUATION COMMUNICATION INSTALLATIONS

These speaker units are fitted with M1109 transformers and wire protect type terminals. A separate pair of terminals is provided for the incoming and outgoing cable loop. Normally supplied connected to the 1W tap. Isolation capacitors for line monitoring can be fitted at a nominal additional cost.

C 2104 100mm (4 in) **$29.50** 10 up **$28.00**

C 2110 200mm (8 in) **$29.50** 10 up **$28.00**

Ceiling Speaker Grilles

100mm Model

New attractive grill includes push in flush caps to hide fixing screw recesses. Ideal for architecturally sensitive applications eg. office buildings or domestic situations etc.

White C 0810 **$3.95**
10 Up **$3.50**

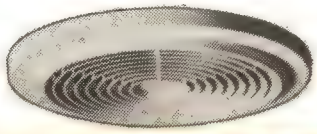
Black C 0811 **$3.95**
10 Up **$3.50**

200mm Model

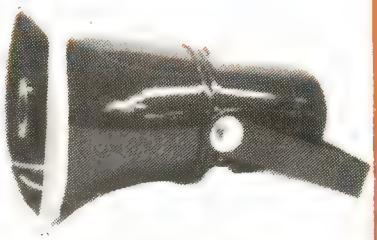
Ideal for PA/Background music systems, extensions speakers etc. Colour White.

Traditional louvered ceiling grill. Includes mounting posts for standard 200mm (8") speaker.

C 0800 **$3.95** 10 Up **$3.50**



8 Ohm Economy Series Weatherproof Re-Entrant Horn Speakers



C 2015 10 Watt PVC
$15.95 5 up $14.80 ea

C 2025 15 Watt Alum.
$39.50 5 up $38.00 ea

Redford Re-Entrant Horn Speakers With In-Built Line Transformer

Our superb Redford Paging Speakers are compact, high intelligibility, double re-entrant horn type speakers suited for indoor and outdoor use for sound, signalling and intercom equipment. Constructed from sturdy weatherproof material, the loudspeakers are recommended for voice applications in Schools, Industry, Commerce and recreation. Screw terminals eliminate the need for soldering. On the 15W and 30W models power output is selectable via screw driver shaft switch housed behind a clear perspex cover plate. All external screws are stainless steel. The finish is textured Mocha Tan epoxy enamel.

The individual performance of each model is outstanding - We believe these will become the industry standard for years to come.

10 Watt

Power Rating: 10/7.5/5/2.5/1.25W
Frequency Response: 225-14KHz
Dispersion: 110 deg.
Sound Level: 110dB
Dimensions: 15x15x20cm
Power output selectable by multiway connector and lead.

C 2027 **$69.00** 6 Up **$66.00**

15 Watt

Power Rating: 15/10/5/2.5w
Frequency Response: 275-14KHz
Dispersion: 110 deg.
Sound Level: 121db
Dimensions: 20x20x23cm

C 2032 **$89.00** 4 Up **$85.00**

30 Watt

Power Rating: 30/15/10/5W
Frequency Response: 300-12Khz
Dispersion: 110 deg.
Sound Level: 125dB
Dimensions: 35x24x27

C 2037 **$110** 4 Up **$104.**

PHONEORDER TOLL FREE 008 999 007

Weather Proof Speakers and Sound Columns By Redford

- Rugged extruded aluminium construction
- Superb black or white powdercoat industrial paint finish
- Engineer designed in Australia
- Excellent reproduction
- Superior to imports - yet just a fraction of the price!

AUSTRALIAN MADE

Redford is the solution for high quality sound reproduction outdoors. The Ten Models to choose from "Fit the Bill" from applications on boats to high grade paging and music entertainment installations.

Rugged Extruded Construction

These vibration free enclosures are constructed from die extruded heavy gauge aluminium and finished with incredibly durable industrial powder-coat enamel. The speaker ends are sealed via gaskets and tough moulded "LURAN S" UV resistant end caps. The end result is "Good Looks" together with assured rugged durability for the Australian environment.

Excellent Reproduction

The drivers have been chosen for wide range, low distortion, mid range "presence" (essential for high grade vocal work) and high efficiency in general. **Power Capacity** for short term use, the drivers will safety handle 150% of rated power. Acoustic wadding is used to dampen Bass resonance. **Weather Proof Construction and use of "Doped Cones".** Foam plastic and cloth is sandwiched between baffle and front grill to prevent water ingress. A first for ***Redford*** is the use of a patented cone moisture repellent process for all models.

Redford Sound Columns are Great for Indoors Too!

The directional characteristics of ***Redford*** sound column speakers eminently suit them to indoor applications such as Halls, Shopping Centres, Air Terminals, Churches, Gymnasiums, Squash Courts and 1000 and 1 other applications. Sound columns are especially helpful in overcoming reverberation echo and microphone "feed back" or whistle. When mounted vertically, ***Redford*** sound columns can be "focused" to provide an (almost uncanny) even sound pressure level from front to rear of audience.

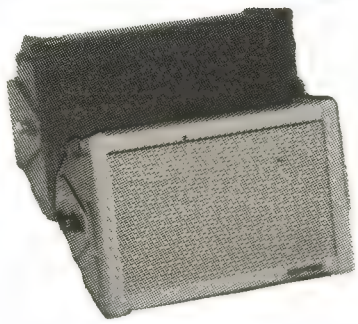
Installation Hardware

Each speaker system is supplied with wall mounting brackets. These enable quick and easy speaker installation and allow simple adjustment in the vertical and/or horizontal plane.

Sound Column to Mic Stand Adaptor

Ideal for portable PA systems. Adaptor simply screws into column speaker and onto standard ⅝" 27 TPI microphone thread. Suits all speakers/sound columns. Suitable for use on C 0505, C 0510 type mic stands.

C 0990 $9.95



Hi Fi Extension Speakers

MASSIVE 100 WATT INPUT RATING MAKE THESE MODELS SIMPLY BRILLIANT AS EXTENSION SPEAKERS FOR HOME, CLUB, HOTELS ETC.

The new versions of these models include a natty little built-in protector allowing around 100 watt input without damage to the drivers. Another fantastic feature from ***Redford***.

Single Driver 16 Ohm 10 Watt

Single dual doped cone driver 16 Ohm impedance is employed to give generally correct volume balance with main speakers - an added bonus is your amplifier load is kept to respectable limits. Great for back patio, den, boat deck etc.

C 0938 White C 0940 Black $115ea $220 per pair

Dual Driver 8 Ohm 20 Watt

Uses 2 dual doped cone drivers for those wanting a bit more oomph!

C 0944 White C 0943 Black $149ea $280 per pair

PA System Sound Columns

10 Watt 100V Line

Uses 1 doped cone driver and fitted with grain oriented steel multitapped transformer.Output cable allows connection to 10W, 5W or 2.5W as desired. Polar output pattern reduces acoustic feedback.

C 0942 White C 0941 Black $125ea $240 per pair

20 Watt 100V Line

Uses 2 doped cone drivers also fitted with grain oriented steel multitapped transformer. Output cable allows for connection to 20W, 10W and 5W as desired.

C 0946 White C 0945 Black $179ea $330 per pair

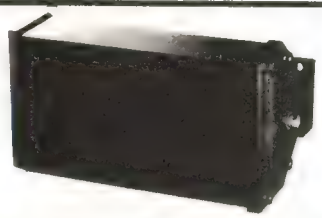
40 Watt 100V Line

Double the size-double the power of the 20 Watt version. Apart from the power handling capacity the big advantage is directivity for use with vocal entertainment systems. Output cable allows for connection to 40W, 20W or 10W as desired. Super directive polar pattern greatly reduces acoustic feedback.

C 0955 White C 0950 Black $245ea $450 per pair

Audio Purists This Is For You!

VIFA 2 Way 100 Watt Weatherproof Speaker



Redford and **Scan Audio** have combined resources to develop this high performance weatherproof speaker system. The heart of the system is the now famous 5" VIFA Woofer/Midrange, computer optimised for use in a 5 litre Bass reflex cabinet. The classic VIFA 19mm ferro fluid Dome Tweeter is incorporated with the crossover network as employed with the SA-50 bookshelf system. The system is fitted with a unique overdrive protection device enabling amplifier input of up to 100 Watts without damage. The combination of the internationally acclaimed VIFA drivers with the rugged **Redford** extruded aluminium enclosure give an overall performance and appearance that is superior to any competitive weatherproof speaker on the Australian market.

Each speaker is supplied complete with mounting brackets. C 0970 Black C 0972 White $199.50 ea $390.00 pr

New Option

Same quality as above but fitted with 40W 100V Line Transformer. Excellent in Bars, Nightclubs etc.

C 0974 Black C 0976 White $249.00 ea $470.00 pr

PHONEORDER TOLL FREE 008 999 007

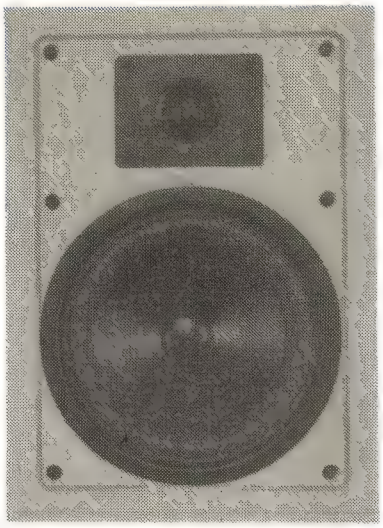
High Performance 2 Way Flush Mounting Full Range 60W Speaker System

Designed to install into ceilings or walls this slim profile attractive speaker system/grille assembly will compliment any sound system.
Once installed the finished unit blends beautifully into any decor. (The grille assembly can be painted over in the same finish as walls or ceilings if required) The system incorporates a 6.5" Poly Carbonate Cone Woofer fitted with a High Temperature Voice Coil and 10 oz magnet. This is accompanied by a 1" Soft Dome Tweeter with a High Temperature Voice Coil. These are then coupled together by a Computer Designed Crossover.
Installation: Installation is simplified by the use of a mounting frame (which could be installed during construction) which the speaker assembly attaches to. Full mounting kit (even screws) supplied.
Weather Resistant Construction: With the use of Poly Carbonate Cone Speakers and carefully selected plastic materials these speakers are suitable for outdoor use. We suggest though for prolonged life they are not installed in exposed conditions i.e. they should be installed under eaves etc.
Features • 6.5" Woofer • 1" Tweeter • 2 Way Crossover • Weather Resistant • Frequency Response 50Hz-22KHz • 8 OHM Impedance • Sensitivity 90db • Dimensions 307(H)x219(W)x84(D).

C 0880 $125.00 ea $225.00 per pair.

NEW FOR '91

Note: For large PA/BGM installations they can be fitted with a 100V line transformers similar to M1130 40W model.



Front grille not illustrated

Down Light Lookalike Ceiling Speaker

Another fantastic innovation from **Redford.** The body of this fine loudspeaker has been designed to imitate the appearance of a **"Down Light".** Excellent for domestic use and architecturally sensitive situations from Office Buildings to Restaurants and Art Galleries. Supplied with the superb **Redford** C 0626 Dual Cone wide range 100mm (4") 15 Watt driver. Excellent reproduction. Easy to install.

Available in 8 ohm or fitted with M1106 transformer for PA/BGM applications.

8 OHM 15 WATT $29.50 EA.
C 0980 White Rim with light grey inner
C 0981 White Rim with dark grey inner

100V LINE .5-5 WATT $35.00 EA.
C 0982 White Rim with light grey inner
C 0983 White Rim with dark grey inner

PROUDLY MADE IN AUSTRALIA

Want a set of high grade extension speakers for the back patio, games room, den, workshop, kitchen? - This great little kit includes speakers, grilles, wire, screws, controller - the works!

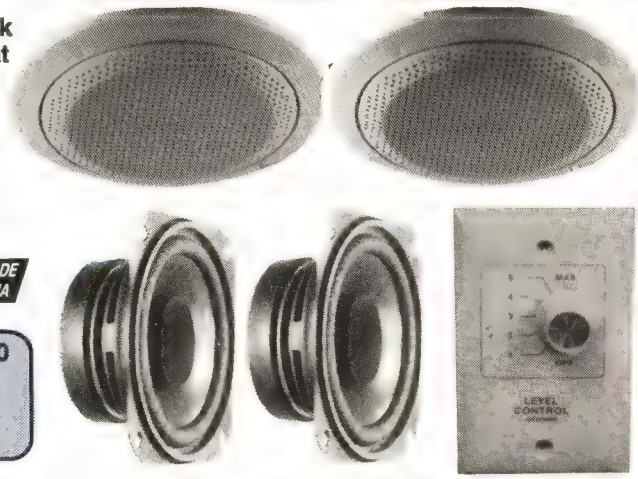
Stereo Extension Ceiling Speaker Kit

Complete system ready to install in your home. Redford wide range 100mm (4") 15 Watt drivers comprise the heart of the system. The performance of these drivers when fitted to the ceiling is quite stunning.
Kit Contents:-
2 x **Redford C 0626** Drivers, 2 x **Redford C 0810** Grilles
1 x **Redford A 2300** 60 Watt stereo volume controller.
2 x 20M rolls speaker wire
Mounting screws.

PROUDLY MADE IN AUSTRALIA

C 0988 $99.00

Available separately, Redford 60 Watts stereo volume controller.
A 2300 $49.95



Decorative All Metal Ceiling Grille

PROUDLY MADE IN AUSTRALIA

For those areas that require a grille a little more up market than the normal plastic type, then this is the answer. Attractive, easy on the eye this grille when installed, blends perfectly into any decor. Installation of the two part grille is a breeze with the mounting rings unique spring loaded mounting tabs adjusting to virtually any ceiling thickness and eliminating all fixing screws. The grille complete with speaker then simply "snaps" into the mounting ring. Excellent for Domestic use, Office Buildings, Restaurants, Art Galleries etc. The grille is available in two versions **1)** Complete with 8" 8 Ohm 10W Dual Cone speaker (suitable for Hi-Fi extension speakers) **2)** Complete with 8" 8 Ohm 10W Dual Cone speaker and 5W 100V Line Transformer (suitable for PA/BGM installations). Both models coloured white (grille and mounting ring can be painted if required.)

C 0985 8 Ohm Version **$39.00** **C 0986** 100V Version **$45.00**

FANTASTIC VALUE

PHONEORDER TOLL FREE 008 999 007

AUDIO

Harris Four Channel Digital Recorder/Announcer

Designed around the TMS 3477 digital recorder IC, this brilliant Australian made recorder has no moving parts and will play indefinitely.

This Remarkable product can be simply switch select programmed to fulfill an amazing variety of functions.

The Harris A 2100 provides 4 channels of natural speech recording and play-back.

Recording time for each channel is internally selectable to 10, 15, 20 or 30 seconds. The sound quality is outstanding on the lower settings and "industrial" on the higher ranges

Channels can be used separately or linked to provide one long recording/announcement.

FACILITIES/FEATURES

- **Microphones Input** balanced line, low Z, input 5 PIN DIN socket (mates with Redford C 0372 desk mic).
- **Auxilliary Input** — 100K .2V sensitivity, e.g. for CD, tape deck, Tuner, BGM line.
- **Channel Select Pushbuttons** — A, B, C, D or A + B + C + D, i.e. when activated will playback which ever is selected.
- **Timer Switch** — automatically initiates the play back of the selected channel. Intervals are 10, 20, 30 seconds, 3, 6, 12 and 30 minutes and off.

Remote microphone operation and PTT.

Remote switch message actuation input.

- **Cycle Pushbutton** — enables playback of each channel in sequency via the Timer Switch.
- **Paging Playback Switch** — allows selection to 'instant replay', i.e. an announcement or recording is played back immediately after being recorded.
- **Line In/Line Out** — zero gain circuit enables you to 'pipe' a music source such as BGM on tuner, cassette deck etc. through the recorder. The line will interupt with the recorded announcements as desired.
- **Back Up Battery** — retains recordings in memory in the event of mains failure for approx. 36-48 hours.

LITERALLY DOZES OF APPLICATIONS

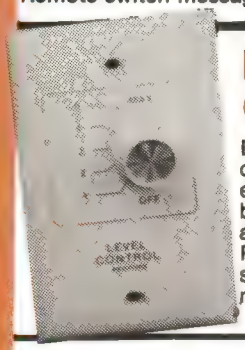
- **Music on Hold Adviser** — Over 50% of phone calls are placed on hold — use this time to promote your business or products.

Information Guide — Great for displays trade shows, self guided tours and even art galleries.

- **A Security Guard** — Gocd weather or bad, holidays and weekends, it stays on duty 24 hours a day to query and direct all personnel at stores, warehouse, plants, offices, hospitals and parking facilities. And for apartments, hotels, estates and more — whenever you wish to screen traffic.
- **PA System Feedback Eliminator** — With the Harris Announcer, feedback is eliminated. Just operate on Paging Playback mode and once the announcement is recorded it will automatically page. Self resets ready for the next message.
- **Emergency Signals** — and/or security warnings can be generated automatically or at the push of a button.
- **Advertisement Announcer for Retail Stores** — Either record your own ads or have them commercially produced — play through your PA/BGM system as often as desired with the interal time.

A 2100 $799.00

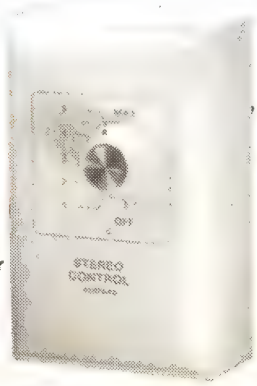
EXCLUSIVE TO ALTRONICS



Redford Audio Controllers

Each of these controllers has been designed to install to a standard electrical flush box or HPM mounting block (cat. P 8045). All components are neatly contained on a single PCB. Screwdriver terminals enable simple neat connection within minutes.

Redford Stereo 60 Watt Patio Loudspeaker Volume Control



For years most of us have covered countless miles dashing from the patio into the lounge or family room to "Turn it down"! or "That's not loud enough"! etc. Massive 100 watt music power capacity. Five volume settings plus "off" includes P 8045 mounting block.

A 2300 $49.95

For 100V Line Public Address and BGM Systems

PA 10 Watt 100V Line Resistance Control

A 2320 Standard Model without relay **$29.95**

A 2325 PA Over-ride Model Inc. relay **$35.00**

PA 40 Watt 100V Line Attenuator Control

Uses switched low loss transformer.

A 2330 Standard Model without relay **$39.50**

A 2335 PA Over-ride model Inc. relay **$44.50**

Fail Safe Over-Ride Models A 2325 - A 2335

The Controller PCB is fitted with a two position selector switch and bypass relay. Selector switch to Normal: energising the relay (24V DC to terminals 5,6) by passes the controller i.e. Full input power is directed to speaker load. De-energising the relay configures the device to normal level control function. Selector switch to fail safe: Energising the relay is necessary for normal level control function. De-energising relay bypasses the controller i.e. Full Power is directed to speaker load.

PROUDLY MADE IN AUSTRALIA

PHONEORDER TOLL FREE 008 999 007

Mylar Stereo Headphones With Dynamic Mic and Vinyl Ear Muffs

Simply brilliant Mylar stereo headsets & dynamic mic combination. **Headphones Specs.** 20Hz-20,000Hz, 32 Ohm, 3.5mm stereo jack, 6.35mm stereo jack adaptor.
Microphone specs: Dynamic type, 300 Ohm, 100Hz-15,000Hz -80db @ 1 KHz, 3.5mm Mono Jack

C 9055 **$36.95**

Brilliant Digital Headphones

Incredibly Comfortable
Utilizes newly developed flat disk vibrator and copper clad aluminium wire voice coil and samarium cobalt magnet. The resultant reproduction is outstanding. Impedance 45 Ohms. Max. input 400mW. Freq.Res. 20Hz to 20KHz.

C 9010 **$29.50**

High Performance Mini Headphones

Superb lightweight Hi Fi stereo headphones. Super comfortable foam ear muffs. 29mm samarium cobalt speakers. Sensitivity 100db. 7'coiled lead 3.5mm gold plated stereo plug and 6.3mm gold plated stereo adaptor.Impedance 32 Ohms, max. input 250mW.

C 9002 **$24.95**

Mini Headphones

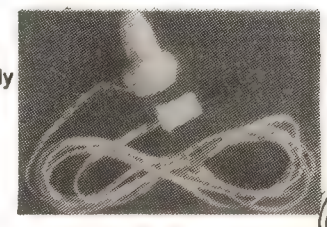
Fitted with 6.5mm stereo plug, light weight and comfortable. Amazing performance for low cost phones.

C 9001 **$8.95**

Magnetic Earpiece

For radios, tape recorders, etc. Magnetic 8 Ohm earpiece with 3.5mm plug, as used extensively in tape recorders, radios, etc. Ultra-thin cord for non-tangle use.

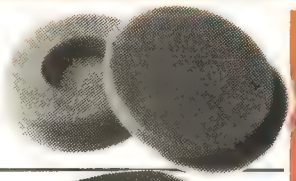
C 9000 **0.95c**



Headphone Foam Earmuffs

Suit Sennheiser style headphones.
2 pairs per pack

C 9025 **$4.95 pack**



AUDIO

AVIATORS HEADSET

WITH OIL FILLED EAR CUSHIONS

Why pay $400 or more for a David Clark set?

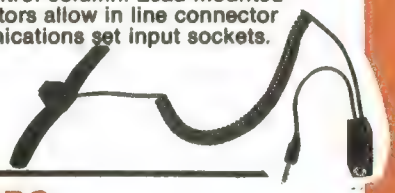
- High performance, noise attenuating earphones.
- Noise cancelling microphone
- Cushioned head pad
- Super sturdy
- Great performance
- Superb, professional pilot's headset will last a lifetime with reasonable treatment.
- Includes standard aircraft jacks.

C 9070 ONLY
$189.00

AVIATION HEADSET PTT SWITCH

Quality microswitch unit. Velcro band enables mounting on Aircraft control column. Lead mounted male and female connectors allow in line connector from headset to communications set input sockets.

C 9090 **$39.95**



CROSSOVERS

2 Way

Impedance 8 Ohm
Crossover 5kHz, 6db/octave
Input Power 60 Watts

C 4002 **$8.95**

3 Way

Impedance 8 Ohm
Crossover 800Hz, 5kHz, 6db/octave
Input Power 80 Watts

C 4003 **$19.50**

L Pad Level Control

Fully sealed type for use with speaker crossover system.

Midrange C 4010
High C 4012 **$7.95**

Black Speaker Cloth

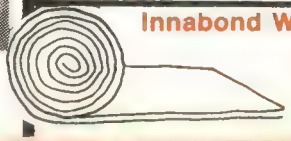
'Easy fit' acoustic cloth. Very pliable, one way stretch. Allows neat and easy application to speaker box front. Extra wide 1.5m. One metre length does a pair of average Hi-fi speaker boxes.

C 3520 **$15.95 per metre**

Innabond Wadding

A must for speaker box enclosure lining. 1.5 metre wide x 40mm thick.

C 3510 **$10.95 per metre**



Quality Microphones From Altronics

From the budget C 0368 to the silky smooth professional entertainers, ***"Redford"*** series have all been carefully performance-evaluated by us — all represent excellent value.

Electret Microphones

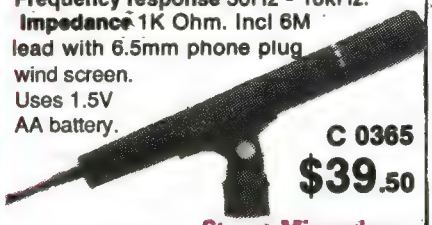
Uni-Directional Cardioid

Recommended for vocalist, public address & general purpose entertainment use.
Frequency res. 20Hz - 15KHz.
Impedance 600 Ohm. Inc. 6M lead with phone plug and wind screen.
Uses 1.5V AA battery.

C 0360 **$39.50**

Omni Directional

Recommended for recording & eminently suited for wide angle sound pickup, i.e. choirs, orchestras, etc.
Frequency response 50Hz - 18kHz.
Impedance 1K Ohm. Incl 6M lead with 6.5mm phone plug wind screen.
Uses 1.5V AA battery.



C 0365 **$39.50**

Stereo Microphone

Superb for stereo recording of vocal or music. Includes holder. Fantastic performance.
Freq. response 50 - 18kHz
Impedance 600 ohm
Sensitivity -66db
3M lead
DC 1.5 AA cell

C 0355 **$35.00**

Electret Tie Clasp Microphone

Omni directional quality mic.
Powered by button cell.
Frequency response 50 - 18kHz
Impedance 1K Ohm
Sensitivity -65dB +/- 3dB
C 0350 **$27.50**

Omni Directional Mic Insert Electret

Omni directional. Great little replacement for tape recorders etc. Handy for hobby projects. Includes data sheet and application circuit. 20Hz - 10kHz.

C 0170 **$2.20**
10 up **$1.80**

Uni Directional Mic Insert Electret

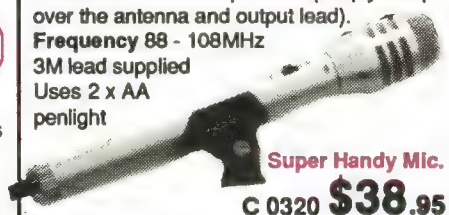
A useful mic insert replacement. Great for the experimenter or application where you wish to cut down background noise.

C 0172 **$5.95** 10 up **$5.40**

Wireless Microphones Receive on FM Band

Two Function Cardioid Microphone

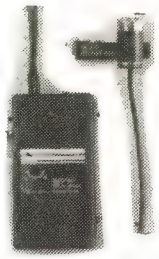
Wireless or electret operation (simply swap over the antenna and output lead).
Frequency 88 - 108MHz
3M lead supplied
Uses 2 x AA penlight



Super Handy Mic.
C 0320 **$38.95**

Lavalier (Lapel)

Superb little microphone. Clips to tie, shirt etc. Ideal for lecturers, religious speakers, stage work, etc.
Uses 1.5V AA battery.
88-108MHz



C 0323 **$39.95**

High Performance ALC (Automatic Level Compressor) Wireless Microphone

Wireless mics suffer from overmodulation distortion when input levels are too high making them unsuitable for high grade vocal entertainment. Use of ALC fixes this.

This Fantastic Model Has Built-In Antenna
C 0328
$129.50

Specifications:
- Cardioid-uni directional pick-up pattern
- Frequency response: 50Hz - 15KHz
- Carrier frequency: 88 - 108MHz adjustable
- Field strength of carrier: Within 50uV/m at a distance of 15M from the mic
- Current consumption: Less than 32mA
- Battery compliment: 1 x 9V
- Weight: 235g

Dynamic Remote Cassette Mic

- Low impedance - 200 to 600 Ohms
- For all portable casette recorders
- Remote on/off switch
- Includes desk stand

C 0367 **$9.95**

Entertainers Microphones

Uni Directional Low Z Budget Dynamic Mic

C 0368 **$19.50**
Sturby "ABS" body, metallic appearance. Surprising voice quality for the price
Frequency response 100-10kHz, 600 Ohm -74+/-3db, on/off swtich, 3M lead. Includes 6.5mm plug and mic holder.
Fantastic value at this price.

Entertainers Cardioid Microphone

NEW FOR '91

C 0375 **$79.95**

A fantastic entertainers microphone for such a low price - not quite in the league of the C 0385 or C 0390, but perfectly suited to general purpose entertainment. Live PA, etc. Incredibly good feedback rejection.
Very rugged.

Polar pattern:	Cardiod
Impedance:	600 Ohm
Freq. response:	50-15000Hz
Sensitivity:	-75 +/-3dB
Diaphragm material:	Polyester film
Pop Fltr. Switch:	Off/On

Incredible Value
Cannon connector 5M lead included

Ultra Cardioid With Laminated Metal Vacuum Evaporated Film Diaphragm

C 0385 **$119.95**
Simply superb entertainers microphone. Silky smooth response (useable to 18kHz). Extremely low feedback incidence. In-built wind filter eliminated "Pops". Balanced line circuit enables long mic cable runs.

Polar pattern:	Cardioid
Impedance:	600 Ohm
Freq. response:	50-1500Hz (useable to 18kHz)
Sensitivity:	-77 +/-3dB
Diaphragm material:	Laminated metal vacuum film
Switch:	On/Off with lock
Pop filter:	Built-in

Sturdy carry case included
Cannon connector & 5M lead included

PHONEORDER TOLL FREE 008 999 007

High Quality Entertainers Microphone

Uses the famous Shure SM 58 insert

Assembled in Taiwan, however in our humble estimation sounds every bit as good as the American assembled product.

Fantastic value at this price.

Polar Pattern: Uni Directional
Impedance: 150 Ohm
Freq. response: 50-15,000Hz
Sensitivity: -57.5dBm
Cartridge: Shure SM 58

As used on many stage productions

C 0390 $225.00

Standard Communications Mic

Low impedance Dynamic mic. with curly cord (incl. switch pair). Great for the CB, intercoms, etc.

- **Frequency Response** 300-8KHz
- **Impedance** 500 Ohm
- **Sensitivity** -70dB

C 0332 $17.95

For Professional 2 Way Radios on Aircraft, Boats, Vehicles & also Industrial PA Systems.

Noise Cancelling Microphone

Fantastic voice clarity and absence of feedback and background noise with this microphone. A great addition to the Altronics microphone range.

Frequency Response 400Hz-8kHz
Impedance 160 Ohms
Sensitivity -65dB (5cm from sound source)

C 0334 $29.80

Professional Paging Mic

Has tapered low frequency response for articulate speech reproduction. Low impedance balanced line. PTT switch for remote switching muting etc.

C 0372 $89.00

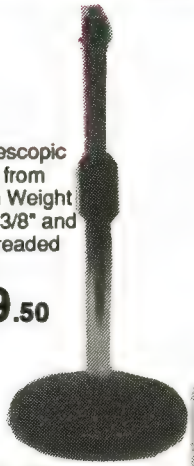
Polar Pattern Cardioid
Impedance 600 Ohm
Freq. Res. 200Hz-8kHz
Sensitivity -70 + 3dB
Dia. Material Polyester Film
Switching Electronic
Housing Die cast zinc
Dimns. 85 x 125 x 291mm
Cable Twin plus shield plus muting pair terminated in 5 pin din plug

Microphone Accessories

Desk Stand

Die cast base, telescopic height adjustment from 220mm to 380mm Weight 1kg dual purpose 3/8" and 5/8" Mic holder threaded adaptor inlcuded.

C 0500 $29.50



DIRECT IMPORT PRICE

Telescope Floor Stand

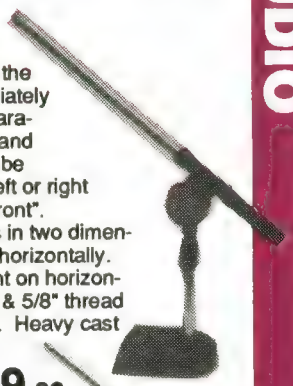
Quality, stable floor stand single draw telescope stem fitted with friction grip and dual screw adaptor, 3/8" and 5/8" for microphone holder.
Height: 96cm to 154cm
Weight: 3.4Kgs

C 0510 $69.00

Banquet Desk Stand

Great where the speaker requires the desk area immediately in front clear of paraphenalia. This stand allows the mic to be placed to either left or right or "distanced in front". Stand telescopes in two dimentions vertically & horizontally. Swivel adjustment on horizontal arm Dual 3/8" & 5/8" thread adaptor supplied. Heavy cast base.

C 0505 $49.80



Telescope Stand With Boom Arm

Has obvious applications for musicians and for where a number of microphones are employed with one speaker.
Height: 96cm to 160cm
Boom extends 70cm from vertical tube.

C 0515 $94.95

Gooseneck Extension Arms

C 0410 300mm Length **$9.50**
C 0412 450mm Length **$12.50**

Mic Holder 5/8" Thread

C 0401 $4.50

Gooseneck Bench Mount

C 0420 $2.95

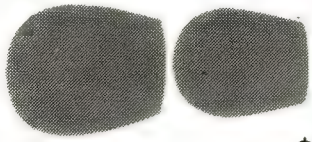
Mini Microphone Stand

Mic stand has fold in legs and stands 86mm high when extended.
Threaded 5/8".
Microphone Not Included

C 0490 $7.95

Microphone Windscreen

Three handy sizes - helps eliminate outdoor wind noise and "Pops" caused by breath proximity.



C 0340 20mm for Pencil Mics **$1.95**
C 0342 27mm for Med. Mics **$1.95**
C 0344 40mm for Bell type Mic **$2.20**

Spring Loaded Microphone Holder

Powerful spring loaded jaws hold most sized microphones.
Standard 5/8" x 27 thread
Colour: Black

C 0405 $5.95

Mic Stand Reducer

Reduces from 5/8" to 3/8"

C 0990 $9.95

Professional PA amplifiers Designed by Altronics

30 Watt Line Output Public Address Amplifier

With Balanced Mic Input & Muting

PROUDLY MADE IN AUSTRALIA

Developed right here in Australia by Altronics
The Altronics A 2000 utilizes balanced input, drive output and feedback circuitry to achieve performance and stability unheard of with low cost amplifiers. The A 2000 will operate happily into all sorts of capacitive and inductive loads, long lines, speaker transformers etc. Eminently suited for use by schools, sporting clubs, function centres as well as with professional installations (paging systems - background music).

NEW IMPROVED CIRCUIT

SPECIFICATIONS
Balanced low impedance mic 200-600 Ohm. Input socket 5 pin Din (line 1 and 3, earth pin 2) **Unbalanced low impedance mic input** 200-600 Ohm 6.35mm JACK socket. **Switched mic muting** making pins 4 and 5 of mic Din socket will mute aux programme. **Vox Mic Muting.** When PCB VOX mid switch activated the aux programme is united with mic audio input. **Auxilliary input** RCA 100K Ohm. **Treble and Bass Controls** individual boost and cut controls provided for auxilliary channel only. **Bass Cut** switch for mic. **Low Z Speaker Output 4-16 Ohm. Line output** 100V line (balanced). **Power Output** full 30 Watts RMS into either 4 OHM or 100V line. **Distortion** typically less than 1%. **Frequency Response** 40Hz to 15kHz.

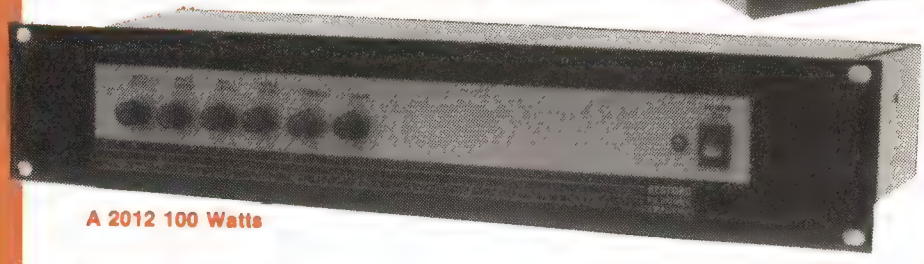
Constant Voltage Design
Output power level will not audibly alter with wide variations in speaker (or output load) i.e. with several speaker circuits the operator may page to one or all together without the level audibly varying at any one circuit.

2 Year Warranty **A 2000 $279.00**

Economical High Performance PA Amplifiers

PROUDLY MADE IN AUSTRALIA

A 2010 60 Watts



A 2012 100 Watts

Look at the features:
- Three different input connectors for each mic input i.e. 3 pin canon female, 5 pin Din, 6.35mm JACK socket.
- Balanced low impedance line input for canon and Din mic inputs.
- Unbalanced low impedance line input for JACK mic inputs.
- Twin RCA input sockets for both auxilliary inputs. E.g. when the auxilliary input source is stereo (CD, tape deck, FM MPX tuner) the left and right channels are thus combined to mono without the necessity to make up special leads.
- Auxilliary PCB socket — will accommodate siren/chime modules etc.
- PTT muting of auxilliary inputs on MIC inputs 1 or 2.
- VOX muting on mics 1 and 2 — PCB DIL switch selectable active/non-active.
- Bass cut switch on rear panel for mic channels.
- Toroid power transformer for reduced weight and heat generation.
- Thermal cutout plus AC and DC fuse protection.
- 100V line and 4-16 Ohm output.
- DC terminals provided for 24V operation.

SPECIFICATIONS:
Output Power: 60W A 2010, 100W A 2012
Output Regulation: Better than 2dB
Signal to Noise Ratio: Better than 65dB
Frequency Response: 40Hz to 16kHz (3db)
Typical Distortion: Less than 1.5%

A 2010 60 watt RMS output
$499.00

A 2012 100 watt RMS output
$599.00

PHONEORDER TOLL FREE 008 999 007

Rack Mounting Professional Public Address Amplifiers Deliver Stunning Performance on 240V AC and 24 - 28V DC

PROUDLY MADE IN AUSTRALIA

Amplifier Models A 2022 **125W** and A 2032 **250W**
3 Mic Inputs: 200 - 600 Ohm 5 pin din socket balanced pin 1 and 3 signal, pin 2 earth unbalanced input. Jack socket on mic 1 only.
2 Auxiliary Inputs: 100K Ohm 200mV sensitivity for full output. 2 x RCA input socket (stereo to mono conversion).
Treble and Bass Control: On auxiliary inputs only +/- 10dB at 100Hz and 10KHz.
Output Terminals: Screwdriver terminal strip 100V, 4 - 16 Ohm, 24V DC input.
Power Amplifier Models: A 2020 **125W** and A 2032 **250W** Input 3 pin XLR type socket earth pin 1 balanced line 2 and 3. Switch allows selection to balanced input 10K Ohm or unbalanced input 100K Ohm. **Input Sensitivity** 200mV. Note: Master Level Control mounted on rear panel - set and forget. **Output terminals** screwdriver type 100V, 4 - 6 Ohm, 24V DC input.

Balanced Drive, Output and Feedback Circuit Design Ensures Unconditional Stability Under All Load Conditions

This excellent series of PA amplifiers, engineered right here in Australia is eminently suited to live entertainment PA in addition to commercial public address systems in schools, hotels, sports arenas, etc. Costing $100's less than equivalent imports, these amplifiers deliver full rated output on 24V DC making them ideal for use with emergency power back up installations i.e. fire evacuation systems etc. Each is guaranteed for 2 years from date of purchase. Housed in attractive 3 unit (132mm H) rack case, each is thus suited for rack mounting as well as bench mounting.

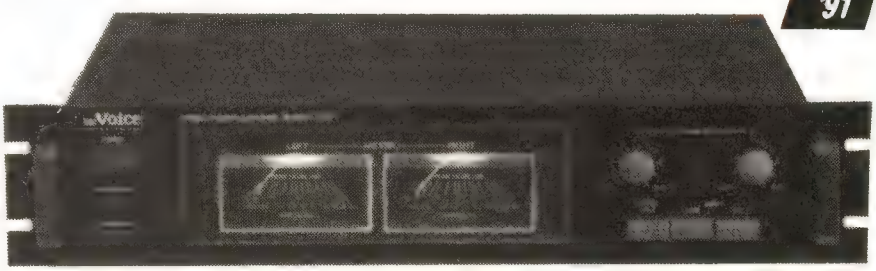
	A 2020	A 2022	A 2030	A 2032
Output Power	125W	125W	250W	250W
Output Line Inputs (Switchable)	100V Line or 4 - 16 Ohm 100K Unbalanced or 10K balanced	100V Line or 4 - 16 Ohm 3 Mic, 2 Aux	100V Line or 4 - 16 Ohm 100K Unbalanced or 10K Balanced	100V Line or 4 - 16 Ohm 3 Mic, 2 Aux
Output Level Regulation	Better than 2dB	Better than 2dB	Better than 2dB	Better than 2dB
Signal to Noise Ratio	Better than 75dB	Better than 65dB	Better than 75dB	Better than 65dB
Frequency Response +/- 3dB	40Hz and 14KHz	40Hz and 14KHz	40Hz and 12KHz	40Hz and 12KHz
Typical Distortion at Full Power O/P	(less than 1%)	(less than 1.5%)	(less than 1%)	(less than 1.5%)
	$599	**$699**	**$799**	**$899**

High Performance Stereo 90W Amp

This stereo amp is ideal for background/foreground applications. Fantastic for restaurants, shops, disco's, aerobics, PA sound systems and home.

- 90 watts RMS per channel minimum into 8 Ohms from 20 to 20,000Hz with less than 0.05% THD.
- 2 large power meter indicators.
- EIA panel with handle device.
- XLR socket for speaker terminal.
- Output relay to eliminate turn-on and off transients.
- Dimensions: (W x H x D) 482 x 92 x 295mm
- Weight: 10.5 kgs
- Ideally suited to A 2210 stereo tuner.

NEW IN '91



A 2040 **$625.00**

AM/FM PLL Tuner

This fantastic tuner is the ideal add-on to any sound system. Can be used as background of music in restaurants, shops etc. or any PA application.
Also a great upgrade for the home Hi-fi.

NEW FOR '91

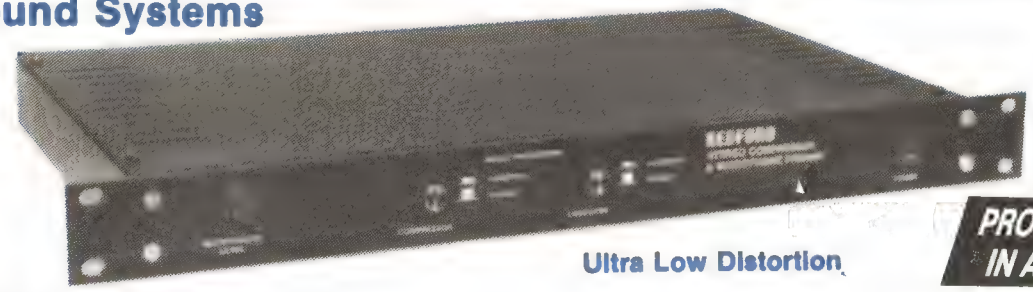
- Digital LED frequency readout display.
- FET FM front end for high image rejection.
- Phase-linear ceramic filters are incorporated in both AM and FM IF section.
- Phase-lock loop (PLL) IC for FM multiplex stage.
- Dimensions: (W X H X D) 435 x 60 x 232mm
- Weight: 3kgs.

FANTASTIC VALUE

A 2210 $199.00

Compress your wide dynamic range CD Music to a format suitable for public address and commercial sound systems with this fine audio compressor/expander.

Compact Disc Stereo Music Compressor for Commercial Sound Systems



Ultra Low Distortion

PROUDLY MADE IN AUSTRALIA

COMPRESSION AND EXPANSION

Multi disc CD's are becoming increasingly used for commercial situations such as boutiques, trendy bars, restaurants and the like. The obvious benefit is the ability to play popular high quality discs of a type suited to the application.

A big problem arises, however, especially when operated in the "RANDOM" select mode. One track will be particularly loud with the following track quiet. The result is, the operator, is frustrated by the music level variations or is forever turning the volume up or down.

The Redord Compander fixes all that. Loud music passages are compressed and quiet passages are expanded (or lifted) in volume. The resultant dynamic range is thus processed to a format suitable for both background or foreground music. Most FM radio stations employ this technique.

"Compansion" is especially helpful in noisy situations such as supermarkets, crowded bars etc.

MICROPHONE INPUT

A low impedance balanced line input is provided to enable paging in conjunction with this unit. PCB switches are provided for:-

Mic Bass Cut — for greater intelligibility in difficult acoustic situations.

Vox Muting — When selected active : microphone use will mute the two music channels.

Mic Compression — Technician selected on or off as desired.

LOUDNESS EQUALISER

This boosts the bass frequencies by around 10dB at 100Hz and high frequencies 3dB at 10KHz. This equalisation is very beneficial for the Redford sound column speaker range and with 100mm (4 inch) ceiling speakers : especially when operated at low volume.

Input — Mic 3 pin female canon type socket. Aux 2 X RCA connectors for left and right channels.

Output — 2 X RCA for left and right channels.

Power Source — 240V 50 Hz AC
Dimensions — 482mm x 44mm x 255mm

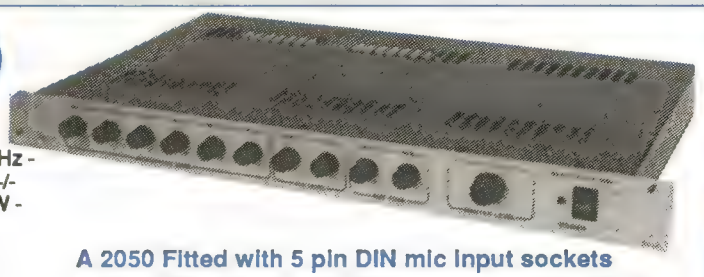
A 2060 $399.00

PHONEORDER TOLL FREE 008 999 007

Redford 8 Channel Mixer

Housed in Stylish 1u 19" rack mount chassis
Specifications:
Inputs 6 microphone - balanced - 200-600 Ohm, 2 Auxiliary unbalanced 100K Ohm. **Output** 600 Ohm balanced 0dBm. **Sensitivity** Mic 1.25mV - Aux 100mV. **Frequency res.** Mic 30Hz - 15kHz, Aux (Flat) 18Hz - 23 kHz. **Tone controls** bass 100Hz +/- 10 dB, treble 10kHz +/- 10dB. **Signal to Noise** all controls CCW - 98dB. **Distortion** at 1kHz, less than .3%. **All measurements measured in respect to 1kHz reference.**

ULTRA LOW DISTORTION **$399.00**

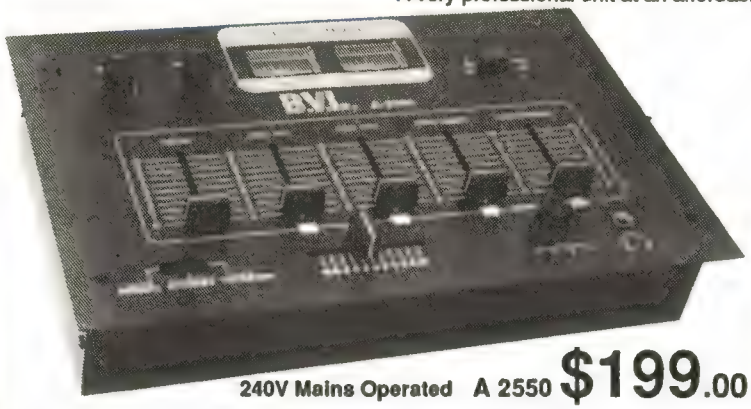


A 2050 Fitted with 5 pin DIN mic input sockets
A 2051 Fitted with 3 pin Cannon type mic sockets

Attention - Social clubs, Schools, Churches, Disco Operators, Entertainers, Hotels, Night Clubs & Sporting Bodies. With Altronics low prices - here is your opportunity to install one of these outstanding sound control mixers. Both models include microphone "soundover" facility - making either ideal for live entertainment use.

Stereo Audio Mixer

This brilliant little mixing console is absolutely packed with features. Allows blending of microphones, two phono inputs and either two tape or tuner inputs. ● Right and left VU meters. ● Separate bass and treble controls. ● 5 slide level controls. ● Fader control between phono pickups for professional cueing. ● Headphone monitor switch. ● Talkover facility. A very professional unit at an affordable price.

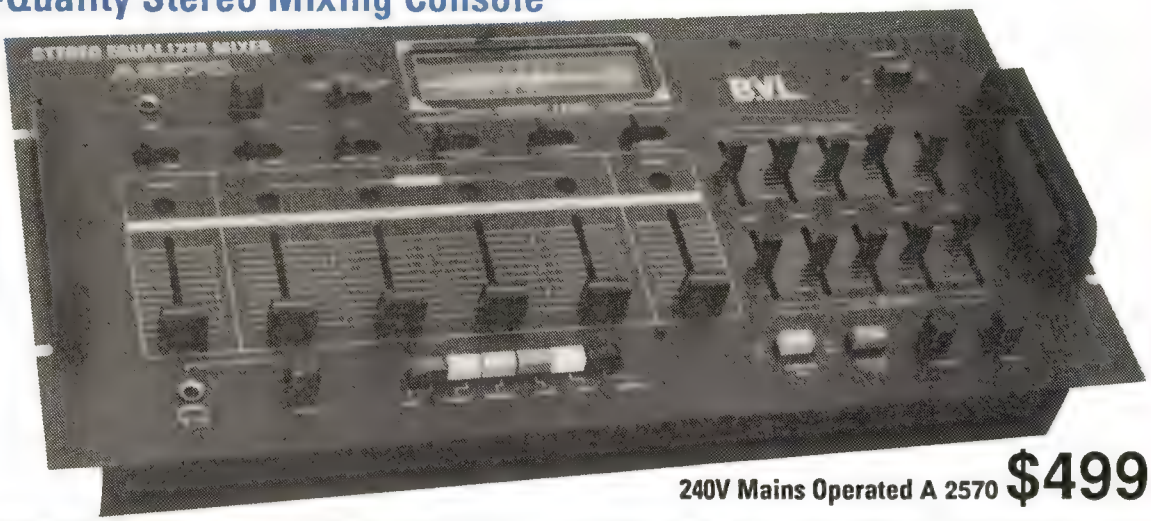


240V Mains Operated A 2550 $199.00

Specifications:

Input:	Mic 0.5mV 600 Ohms Phone 3mV 50kOhms Tape/tuner 150mV 100kOhms
Output:	250mV
Frequency Response:	20Hz to 20kHz (plus or minus 1dB)
Tone Control (Treble):	10kHz (plus or minus 12dB)
Tone Control (Bass):	100kHz (plus or minus 12dB)
Distortion:	Less than 0.07%
S/N Ratio:	More than 60dB
Headphone Impedance:	4 - 16 Ohms
Dimensions:	318 (L) x 217 (W) x 85 (H)

Pro-Quality Stereo Mixing Console



240V Mains Operated A 2570 $499.00

Our sophisticated Audio Mixing Console is ideal for 'live' recording - PA mixing - Fantastic Tape Recordings - Even Stereo/Mono VCR recording. A truly professional deck that features separate R/L 5 band graphic equalisers - Echo and Peak LED level indicators Talkover facility - Separate H/Phone level control - Patch switch bank - Individual microphone, Phono 1, Phono 2, Aux/Line 2, and Master slide level controls. Blend up to two magnetic or cyrstal turntables, two tape decks or turners and two microphones all at once!!

SPECIFICATIONS

Input	Mic 1 - 0.5mV 600 Ohms Mic 2 - 0.5mV 600 Ohms (low imp.) 2.5mV 10K Ohms (high imp.) Phono 1 & 2 (Mag) 3mV 50K ohms Phono 1 & 2 (Cry) 150mV 100kOhms Tape/Tuner 1 & 2 150mV 100kOhms
Equaliser	5 frequency bands - 60Hz, 250Hz, 1kHz, 4kHz, 12kHz - Boost Cut range - plus or minus12dB @ centre frequency
Output:	1.5V/0.775V (Selectable)
Frequency Response:	20Hz to 20kHz plus or minus 1 dB
Distotion:	Less than 0.05%
S/N Ratio:	More than 50dB
Headphone Impedance:	4 - 16 Ohms
Echo:	B.B.D. System
Delay Time:	30 - 200mS
Echo Repeat Control	
Delay Time Control	
Dimensions:	480 (L) x 240 (W) x 110 (H)

PHONEORDER TOLL FREE 008 999 007

Famous Chiayo Go Anywhere Diversity Wireless Microphone and Portable PA System

Powered by 240V mains or internal batteries and equipped with a wireless microphone receiver the Chiayo WA505 series amplifiers have won "The Good Product Design Award" for TAIWAN exports over several consecutive years.

FANTASTIC VALUE

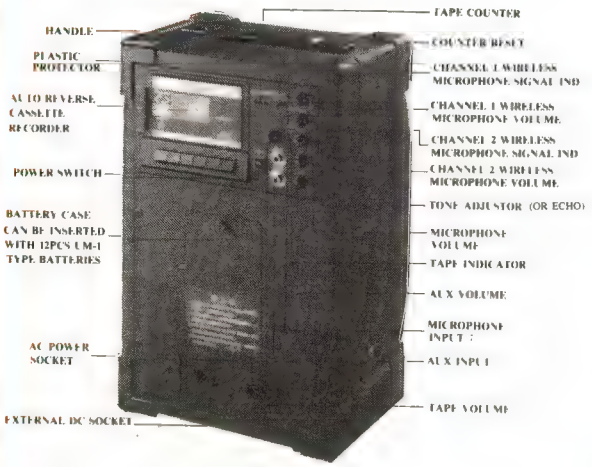
Powerful 50 Watts RMS Amplifier
(20 watts on DC battery power)
Surprisingly powerful for a compact portable system this amplifier is ideally suited to auditoriums, dance halls and sporting areas etc.

Wireless Microphone Receiver
Fitted with the internationally acclaimed Chiayo dual diversity UHF wireless microphone receiver system; the user has all the freedom a cordless system offers without interference noise, fade or sound quality degredation. The microphone can be used up to 200 metres from the amplifier with absolute clarity. Naturally all the standard Redford/Chiayo microphone and guitar pickups function perfectly with these amplifiers.

Inbuilt Tape Deck
Models C0212, C0216 have an inbuilt Cassette tape deck. These have proven fantastic for aerobics groups.

Microphone features:
• No dangling Antenna on Microphone to get in your way.
• High Dynamic range. • Standard 9V batteries give long powerful operation. • Advanced technology SMC construction.

THE FEATURES:



Please note 2 different operating frequencies are available you will need to specifically nominate desired frequency only if the equipment is being used in proximity with other Chiayo Redford systems on the 200MHz band.

AMPLIFIERS

C 0205	Dual Diversity Portable P.A.	202.4MHz	**$899.00**
C 0209	Dual Diversity Portable P.A.	203.7MHz	**$899.00**
C 0212	D/Diversity Portable P.A. with Cassette Deck	202.4MHz	**$1250.00**
C 0216	D/Diversity Portable P.A. with Cassette Deck	203.7MHz	**$1250.00**

ACCESSORIES

C 0262	H/Held Mic	202.4MHz	**$298.00**
C 0271	H/Held Mic	203.7MHz	**$298.00**
C 0274	H/Held Mic Shure SM58	202.4MHz	**$485.00**
C 0283	H/Held Mic Shure SM58	203.7MHz	**$485.00**
C 0286	Lavalier Mic	202.4MHz	**$349.00**
C 0295	Lavalier Mic	203.7MHz	**$349.00**
C 0301	Guitar Pick-up	202.4MHz	**$195.00**
C 0309	Guitar Pick-up	203.7MHz	**$195.00**

New Redford Dual Diversity ½ Rack Unit Size Wireless Microphone Equipment

NOW AVAILABLE WITH SHURE SM-58 MIC. CARTRIDGE

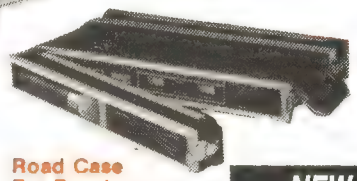
Unique microphone design completely eliminates "dangling" antenna.

Surface mount construction (SMC) has enabled the famous Redford UHF dual diversity receiver equipment to be miniaturized to less than half the previous size. Two units can be housed with a single rack unit escutcheon. A host of new features have been incorporated to allow ease of connection to virtually any amplifier or mixer installation.

C 0312 Antenna

Lavalier Microphone

Guitar Pick-up



Road Case For Receivers

WORLD STANDARD STUDIO PERFORMANCE

Breathtaking performance without signal drop-out or noise interference. The Redford Wireless Microphone System is virtually the ultimate in an Entertainers Microphone system (or any roving microphone application for that matter!).

All the annoying wireless microphone characteristics such as "drop-out" static and noise are completely eliminated by use of auto-switching dual diversity receivers. The ouput of each receiver is continually monitored, with the strongest and clearest signal always selected. Dynamic Range exceeding 100dB is obtained by employment of a patented special Parabola level compressor and dynamic expander.

The operating range is a minimum of 50 metres (often this can be extended to 200 metres and more in normal circumstances). Several Frequencies are available to alleviate cross interference when two or more systems are used in proximity.

ENGINEERING EXCELLENCE

New compact design. By using surface mount technology, the Redford dual diversity is half the size of other receivers.

19" Rack mountable. The optional rack mounting escutcheon enables one or two receivers to be housed in a 1 unit 19 inch rack module.

Built in Antenna Divider and Audio Mixer. The rear panel contains input and output jacks for antenna, audio output and power supply, so you can easily series receivers up to share common antennae, output and power supply.

Tone Squelch. Multi muting tone squelch circuitry eliminates noise and interference when the microphone is in the standby mode.

"Pop Filter" on Receiver and Microphone. Receiver and microphones are both fitted with screening circuitry to eliminate "Pop" on switch off.

Wide dynamic range ensures no distortion at high level input. The sophisticated compander and the low distortion automatic level control circuit, ensure the maximum deviation range under the specified bandwith. Without the distortion commonly present with high microphone audio input levels.

MICROPHONE FEATURES

• No dangling Antenna on Microphone to get in your way. • High Dynamic range. • Standard 9V battery gives long powerful operation. • Advanced technology - automatic switching dual diversity receiving system.

Please note 4 different operating frequencies are available (you will need to specifically nominate desired frequency only if the equipment is being used in proximity with other Redford systems on the 200MHz band.

NOW AVAILABLE WITH SHURE SM-58 MICROPHONE CARTRIDGE

The Famous Shure SM-58 Microphone is now available with the Redford Diversity System.

NEW IMPROVED CIRCUIT

C 0225	Wless RX UHF non diversity	203.7MHz	$399.00
C 0232	Wless RX D/Diversity	202.4MHz	$599.00
C 0235	Wless RX D/Diversity	202.5MHz	$599.00
C 0238	Wless RX D/Diversity	202.9MHz	$599.00
C 0242	Wless RX D/Diversity	203.7MHz	$599.00
C 0248	Rack Mount for two wless RX		$25.00
C 0250	Rack Mount blanking unit		$11.95
C 0255	Roadcase for diversity RX		$149.00
C 0257	Carry-case for H/H D/D mic		$15.00
C 0262	Wless Mic H/Held	202.4MHz	$298.00
C 0265	Wless Mic H/Held	202.5MHz	$298.00
C 0268	Wless Mic H/Held	202.9MHz	$298.00
C 0271	Wless Mic H/Held	203.7MHz	$298.00
C 0274	Wless Mic Shure SM78	202.4MHz	$485.00
C 0277	Wless Mic Shure SM78	202.5MHz	$485.00
C 0280	Wless Mic Shure SM78	202.9MHz	$485.00
C 0283	Wless Mic Shure SM78	203.7MHz	$485.00
C 0286	Wless Mic Lavalier	202.4MHz	$349.00
C 0289	Wless Mic Lavalier	202.5MHz	$349.00
C 0292	Wless Mic Lavalier	202.9MHz	$349.00
C 0295	Wless Mic Lavalier	203.7MHz	$349.00
C 0301	Guitar Pick-up/Tx	202.4MHz	$195.00
C 0303	Guitar Pick-up/Tx	202.5MHz	$195.00
C 0305	Guitar Pick-up/Tx	202.9MHz	$195.00
C 0309	Guitar Pick-up/Tx	203.7MHz	$195.00
C 0312	Antenna Remote for D/Div RX		$79.95
C 0314	Antenna Base		$9.50

Note that while several units of different frequency can be used simultaneously (ie. for individual vocalists etc.) some frequencies interfere with others; so one must take care when ordering particular frequencies with multiple unit installations.

REDFORD-CHIAYO COMPATIBLE FREQUENCY CHANNEL CHART

Compatible Freqencies are listed together.

202.4, 202.9, 203.7	202.9, 202.5, 203.7
202.4, 202.9	202.9, 203.7
202.4, 203.7	202.9, 202.5
202.5, 202.9, 203.7	203.7, 202.4, 202.9
202.5, 202.9	203.7, 202.5, 202.9
202.5, 203.7	203.7, 202.4
202.9, 202.4, 203.7	203.7, 202.5
202.9, 202.4	203.7, 202.9

PHONEORDER TOLL FREE 008 999 007

SECURITY

Protect your Home or Business from Intruders with one of these "State of the Art" Burglar Alarm Security Systems

Theft and burglary have always been with us. However in todays hard economic times it is on the increase rapidly. With "thugs" on the lookout for easy money from the sale of Your hard earned goods, it NOW makes sense to protect your family and possessions with one of these systems.

Economy Alarm Panel

NEW IN '91

For Homes and Small Commercial Premises

This is a 3 zone alarm control panel designed for the protection of homes and small commercial premises. It employs the latest advanced electronic circuitry offering the highest degree of quality and reliability.

It will accept either active or passive normally open or normally closed sensors making it both a versatile and effective protection system.

The panel is well matched with the digital key pad (S 4200) for remote control operation from a convenient location away from the panel, i.e. typically the front door.

FEATURES:

- 3 Independent Protection Sectors
- All Sectors are Compatible with N.O. and N.C. Switches
- All Sectors are Sealed with End-Of-Line Resistors
- Adjustable Timers for Entry Delay and Siren Duration
- Built-In Siren Driver
- Output Relay is Selectable for "Latch" or "Timing" Operation
- Remote Arming and Disarming Control Possible
- Remote and Local Alarm Status Indication

S 5480 $129.00

Keyless 4 Sector Isolatable Alarm Control Panel

For Commercial and Residential Security Systems

This 4 zone panel has been suitably designed for the protection of both commercial and residential properties.

It employs the latest electronic circuitry and the most up-to-date security technology. It has 4 independent individually isolatable protection circuits accepting both normally open or normally closed sensors.

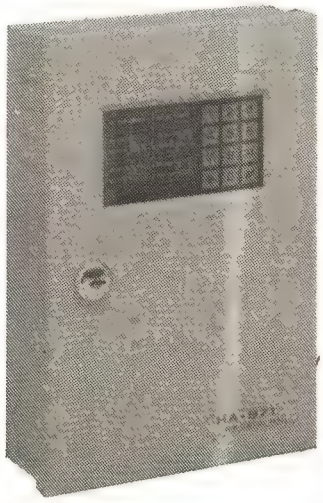
The panel is easily armed and disarmed via the integral inbuilt keypad.

FEATURES:

- 4 Independent User Isolatable Protection Sectors
- Dual Siren Drivers with Tamper-Proof
- Arm - Disarm by Digital Access Key-Pad
- Alarm Recycle or Inhibit Operation Selectable
- Adjustable Siren and Entry Delay Timers
- Forced Arm or Arm Prohibited Operation Selectable
- Multi-Remote Stations possible for Arming and Disarming Control
- Built-In Latched and Timing Output Relays
- Alarm "Pre-Warning" or "Silent" Selectable
- All Sectors are Compatible with N.O. and N.C. Switches
- All Sectors are Sealed with End-Of-Line Resistors

NEW FOR '91

S 5485 $249.00



Stylish — Flush/Surface mount Alarm Control Centre

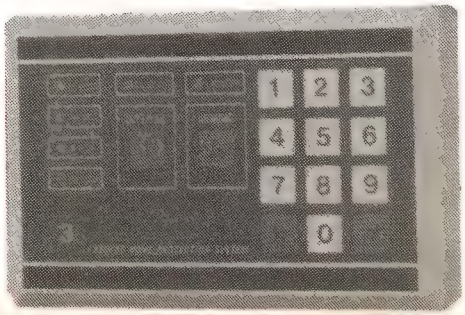
With stylish compact good looks this alarm blends smoothly into any residential or office decor.

This compact 3 section alarm panel has been designed to either surface mount or flush mount into a standard 3 gang electrical wall box.

In order to provide the maximum amount of security and operation convenience the panel is operated via a 4 digit access code rather than a key.

For ease of installation and service, the panel is provided with a plug in wiring harness.

It is ideally suited for use in small commercial premises, offices, apartments, homes etc.



FEATURES/SPECIFICATIONS:

- 3 Indpendent Protection Circuits
- All Sectors are Compatible with N.O. and N.C. Switches
- All Sectors are Sealed with End-Of-Line Resistors
- Adjustable Timers for Entry Delay and Siren Duration
- Auxillary Output Relay. Latch or Reset Selectable.
- Built in Siren Driver
- Arm - Disarm by Digital Access key pad.

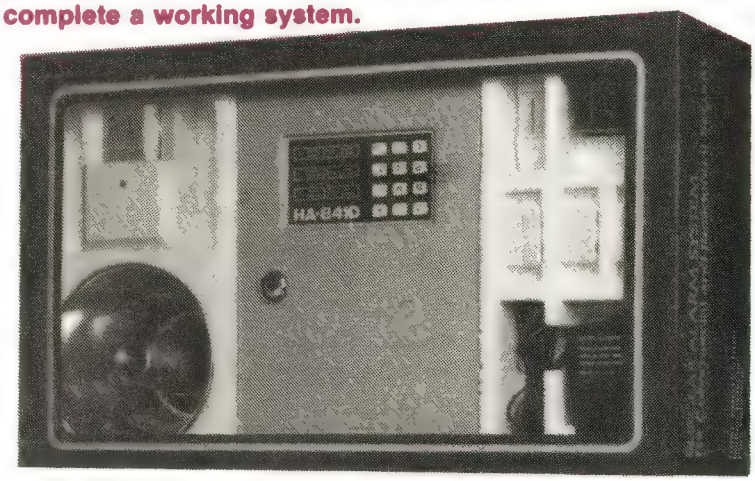
NEW FOR '91

S 5490 $119.00

PHONEORDER TOLL FREE 008 999 007

Economical Alarm System Kit

Supplied with all major components to complete a working system.



This commercial quality kit includes all the major components to install a complete basic security system, easily installed by the Home Handyman.

The kit comes complete with the following components: • One Alarm Panel • One Passive Infrared Detectant (P.I.R.) • One AC Power Pack • One 8 Ohm Horn Speaker • Three pairs of Magnetic Reed Switches • One 12V/1.2AH Rechargeable Back Up Battery.

As is the kit would suit most average homes. Using the magnetic reed switches on external doors and the P.I.R. covering the area containing the most expensive portable equipment, e.g. lounge and games room housing V.C.R., CD, HiFi systems, T.V's etc.

Naturally, the system is fully expandable and can be fitted with extra sensors if required.

ALARM PANEL FEATURES:

- 5 Protection Circuit Loops
- Independent Connections for N.C. and N.O. Sensor Switches
- Arm - Disarm by Digital Access Key-Pad
- Multi-Station Remote Control
- Warble Tone — Steady Tone Siren Driver
- Adjustable Timers for Entry Delay and Siren Duration
- "Latch" and "Timing" Output Relays
- Remote and Local Alarm Status Indication

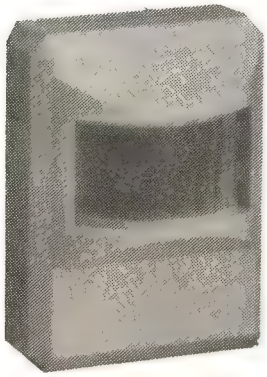
NEW FOR '91

This system is easily installed by the Home Handyman. No special tools or equipment are required. Comprehensive installation instructions supplied.

S 5470 **$349.00**

Mini Passive Infra Red Intrusion Detection

Incorporates Pulse Count Triggering

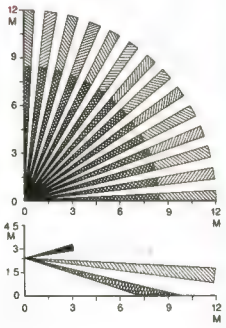


FANTASTIC VALUE

Incorporating the latest technology this compact Passive Infra Red Detector (P.I.R.) features Pulse Count Triggering which virtually eliminates false alarms.

Pulse Count Triggering works as follows. The circuit first senses an alarm (pulse 1) and then goes into alarm standby mode for 30 seconds duration. If during the 30 second standby mode a second alarm event occurs (pulse 2) the detection goes immediately into alarm and the standby period is extended for a further 30 seconds. If there is no second alarm pulse during the 30 second standby mode, the detector returns to the normal state.

COVERAGE PATTERNS



FEATURES:

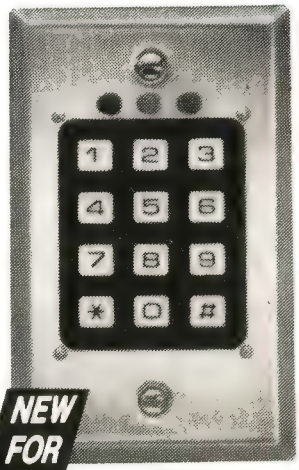
- Dual Element Pyroelectric Sensor
- Programmable Pulse Counter
- Wide 12mx12m 90° angle Detection Pattern
- Surface or corner mounting (Interior use only)
- Wide operational voltage range 8-16V DC.
- Architecturally attractive
- Compact stature 55x31x73mm
- Interfaces with most alarm panels

NEW IN '91

S 5302 **$79.00**

Digital Access Keypad

For Security and Door Strike Applications



NEW FOR '91

This digital access keypad is a 12-button electronic coded combination lock. It provides two sets of secret codes for the owner. There are 11880 different combinations possible for security key and 132 different combinations possible for panic. The secret codes may be instantly changed by the owner by just simply rearranging the code jumper pins in the code bank.

It is designed with the latest electronic circuitry and special Integrated Circuits. It offers high reliability and superb security. The security key section requires 4 separate key buttons to be pressed in a precise and exact sequence. Any deviation from the correct code instantly resets the system. The panic section requires two key buttons to be pressed simultaneously for operation. Both security key and panic outputs are selectable for momentary or latching operation mode. The key pad is immune to all types of EMF, static electricity and RF noise. It also has overvoltage protection and reverse polarity protection circuits.

The keyboard is mounted on a brushed stainless steel mounting plate which is designed to fit into a single electrical gang box and flush mount attractively on wall. The keypad incorporates a normally closed tamper switch which provides tamper proof to the keypad at all times.

The keypad is suitable for most kinds of security systems and electric door strike applications.

FEATURES:

• 11880 possible Security Key Combinations • 132 possible Panic Button Combinations • Wide operating voltage 6-16V DC • Momentary or Latch selectable for both security and panic outputs • N.O. and N.C. relay contacts for both security and panic outputs • Inbuilt Tamper Switch • Alarm Status Indicators • Flush or Surface Mount • Interfaces with most alarms • Eliminates the need for keys

S 4200 **$69.95**

Why Pay A Commercial Security Firm A Fortune To Wire Your House Or Office. This Fantastic System Installs In An Hour Or Two And Uses No Wires

UHF Microprocessor Controlled Wireless Security System

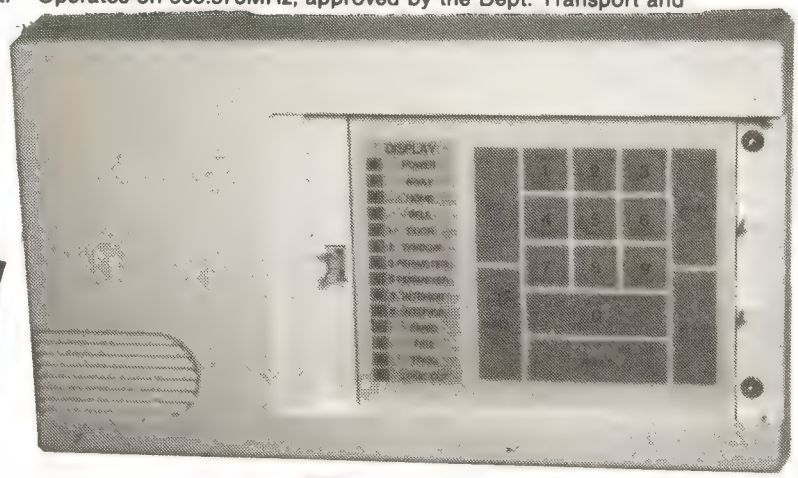
Apart from the flawless operation of the system one of the great features is its application with rented or leased premises — let's face it, money spent on installing a wired system in your home or office, factory, etc. is irrevocably lost when you move on. With this system you simply take it with you.

• 5 modes of operation. OFF, HOME, AWAY, PANIC, BELL. • OFF: Control panel ignores all signals from sensors. • HOME: Control panel responds to all sectors except interior ones, i.e. door, windows and 2 perimeter. • AWAY: Control panel responds to all sectors. • PANIC: Alarm sounds immediately. Can be triggered by the personal remote control, control console or door sensor. • BELL: Alarm sounds only when door sector is activated. This mode can be used as a doorbell with buzzer sounding in the control console only. Ideal for use in shop environment. • Fire zone enabling smoke detectors to be connected. • Silent alarm zone. If a telephone dialler is connected alarm will not sound, so intruder is unaware alarm has been triggered. • Trip switch under control panel cover activates alarm if tampered with. • Up to 6 digit security code for alarm system. • Self test system indicates if a zone or alarm system is faulty. • Self test system indicates last zone triggered. • Internal speaker for alarm and doorbell. • Internal piezo electric device for confirmation of entries. • Exit, entry and alarm times variable from approx. 7 seconds to 3 minutes. • All transmitters have approx. 30 metre range from control panel. • Both users manual and installation manual supplied with unit. • 240 volt operated with back-up battery supply. • Optional wireless remote keypad - ideal if both front and back doors are used for entry/exit. • Operates on 303.875MHz, approved by the Dept. Transport and Communications.

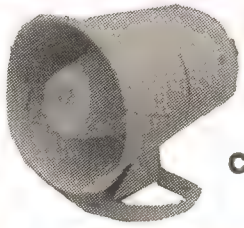
COMPLETE SYSTEM INCLUDES:
1 x Control Panel
1 x Passive Infra Red Detector/Transmitter
1 x Door/Window Reed Switch/Transmitter
1 x Hand Held Remote Control/Transmitter
1 x Horn Speaker - 10 watt/wired
1 x 240V AC adaptor
1 x 1.2Ah Back-up Battery
1 x Set of batteries for all transmitters

S 5240 Complete System

Only $649.00 FANTASTIC VALUE



EASY TO INSTALL
Detection is provided by contact transmitters and passive infrared motion transmitters. Contact transmitters can be fitted at likely points of entry and internal doors and are used in conjunction with magnetic contacts. The passive infrared motion detectors sense the body heat of a moving person.



EXTERNAL SIREN:
The external siren scares off the burglar and alerts the neighbourhood, if the alarm is activated.

C 2015 $15.95

NEW IN '91

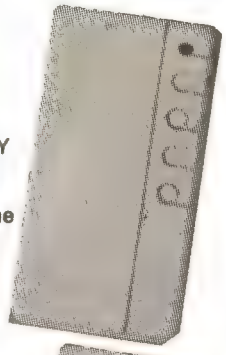
WIRELESS REMOTE KEYPAD:
This allows you to control the system via a remote keypad, which would normally be installed close to the door where you enter and leave the house. It allows you to set the mode of the system by entering a private number, without having to use the Personal Remote Control.

S 5255 $129.00

PERSONAL REMOTE CONTROLS:
Each button on the Personal remote Control is clearly labelled and self explanatory.

The remote control will turn the Control Console OFF, ON (either HOME or AWAY mode), and also includes PANIC.

To place the Control Console in HOME mode, simply press the HOME button. The other buttons work the same to set the system to the various modes.

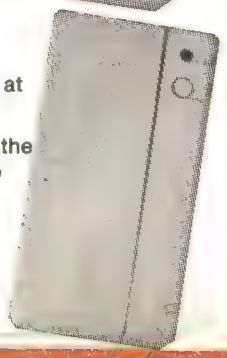


S 5250 $59.00

Passive Infra Red Movement Detector:
Ideal for the lounge room, family room or hallway i.e. anywhere where an intruder is likely to pass through. Mounts up on the wall or on top of bookshelves etc. Detects movement within an area of 9M by 9M by sensing intruder body heat movement through the protected area.

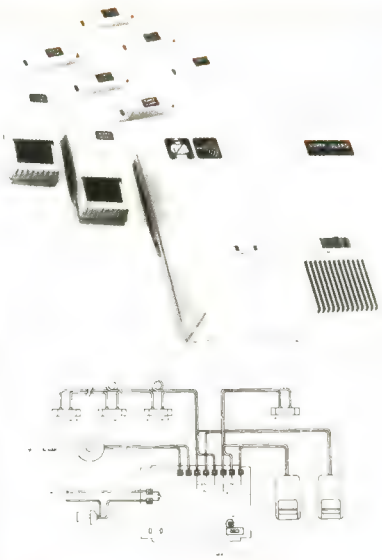
S 5245 $149.00

DOOR/WINDOW REED SWITCH & TRANSMITTER
This consists of an enclosed reed switch and compact UHF transmitter. The unit is at rest when magnet and reed are side by side. When the magnet is moved away more than approximately 25mm it signals the transmitter Main Control Receiver and the alarm is sounded. In practise the Reed/Transmitter is mounted on the door or window frame with the magnet on the moving door or window.



S 5247 $69.00

PHONEORDER TOLL FREE 008 999 007



Super Guard
Household Alarm System

FANTASTIC VALUE

Super Guard is a comprehensive low cost alarm system. Simple to install and operate, this system is great for home or small office.

Three sets of door/window reed relay proximity switches are supplied. Additional switches can be installed as desired. These switches can be connected to the "Instant Alarm" circuit (windows) or "Delayed Alarm" circuit, e.g. front or rear door thus enabling you to disarm the system when re-entering the house.

- Inbuilt Piezo Siren is suitable for a small apartment or flat.
- With larger premises an external siren can be connected.
- Battery Back-Up via 8 or "C" cells (not supplied) in the event of mains power failure or disconnection.
- Front Door Bell facility provided.
- Panic Switch is provided, e.g. for location alongside bed table, etc.
- Easy to operate Simplicity itself — just select the switch to Home, Off or Away as desired. A 45 second exit/entry delay allows you to vacate and/or re-enter your premises and disarm the system.
- No key switches or code buttons to push. Thus the system is ideal for families — even the kids can operate this system.

SYSTEM CONTENTS: Master Control Unit, Front Door Bell Switch, Panic/Emergency Switch, Three Proximity Switches, Mounting Hardware, 20 Metres Wire, Instruction Manual.

FANTASTIC VALUE Complete System **S 5465 $129.00**

Battery Operated Portable Passive Infra-Red Intrusion Alarm

S 5305 $69.00

Ward off theives and intruders at home or when travelling.

This is a portable, battery operated, passive infrared intrusion alarm. It employs the most advanced circuitry offering fully automatic operation and superb performance. The alarm gives over 100 sq. metre protection coverage and requires no height adjustment in operation. It works perfectly at 0.5-2 metres above floor level stood on a shelf or cabinet; or it can be fixed to a wall or the corner of a room at a height the owner can reach for ON-OFF control. If anybody enters the protected area, their movement will be detected and will activate the alarm to turn on the built-in ear piercing buzzer.

The system through its many unique features offers owner total simplicity of use. Unlike other systems, owner is not required to hurry out of the protected area when the alarm is turned on. The alarm's own "brain" will set itself in armed mode after it is satisfied that the owner has left the property; so that the owner can perform walk-testing for protection coverage before leaving as long as he wishes.

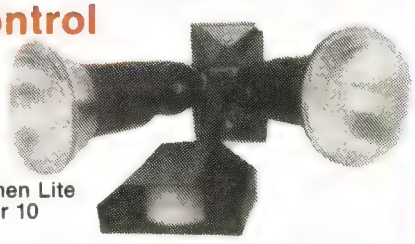
It is an entirely independent and self-contained alarm unit for ready use. It requires no external connection. In operation, all the owner requires to do is simply switch "ON" the alarm, remove the key and leave the protected area. The alarm will do the rest automatically. The alarm consumes very low power at armed mode, a 9 volt alkaline battery should last for few months of daily operation.

FEATURES:

- A ready to use system, no installation.
- Fully automatic operation, very user friendly
- Large coverage, over 100 square metres
- Portable wall mounted
- Long life 9V battery operation
- Battery low warning
- Lightweight, compact and attractive
- Recommended for home, shop, caravan or when travelling.

Passive Infra-Red Lite Aide Floodlight Control

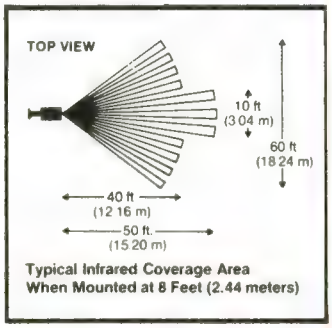
How often have you thought there could be a prowler outside your door? Install a Lite Aide and (once armed) any "guest" will be floodlit when detected by this highly sensitive Infra-Red Detector.



The Light Aide detects a moving person or vehicle by comparing the background temperature with a rapid change of temperature across the detection beams. So when Lite Aide detects movement across the coverage area, it will turn on the floodlight(s) for 10 secs to 15 minutes as pre-adjusted.

IMPORTANT NOTES:

This unit is suitable for external installation, however, the following points should be followed (A) Unit must be located at least 2.5M above floor/ground level (B) Protection from direct weather by roof eaves or decking is preferred (C) Even though the connection to mains wiring is quite simple (all connectors supplied) purchasers are reminded that wiring to energy authority mains supply should always be performed by a licensed electrician.



Typical Infrared Coverage Area
When Mounted at 8 Feet (2.44 meters)

SPECIFICATIONS:

- **Detector:** Dual element pyroelectric PIR sensor.
- **Raintight** outdoor all weather operation.
- **Photocell** to deactivate sensor during daylight.
- **Operating Voltage:** 240V AC, 50Hz.
- **Operation Time:** Adjustable 10 secs to 15 minutes.
- **Sensitivity:** Adjustable 20'-50', 30 beams.
- **Aimable** to desired direction with 2 ball joints.
- **Switching Capability:** 2 x 150 Watt max. Incandescent lamps.
- **Operation Modes:** Off, Auto, Test, Manual On.

S 5350 $99.00

Please Note Flood Lights Not Supplied.

SECURITY

Key Operated Switches

Two Position Single Pole Key Operated Switch

Zinc Alloy Die Cast housing and cylinder with weather-proof shutter. Durable chrome/nickel plated solid brass double fitted key. Silver plated contacts and terminals. 250V/3 Amps. Key removable in both positions.
Dimensions:
Panel hole 19mm, length from rear of front shroud 42mm, 52mm overall. Supplied with two keys.

S 2500 $8.95
10 Up $8.40

4 Pole 2 Position Keyswitch with Weather Guard

Contact: Silver Plated Brass
Max. Working Volts: 300V
Current Rating: 5A

Terminal Count:	Pos.1	Pos.2
A	1	3
B	4	6
C	7	9
D	10	12

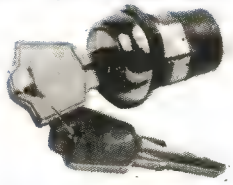
Dimensions:
Panel hole 19mm. Depth 345mm from rear of front shroud, 60mm overall.

S 2510 $12.95
10 Up $12.15

Tubular Key Lock Switch

Chrome plated brass cylinder in a zinc alloy die-cast housing key removable in 'on' or 'off' position. Radial 7 pin tumbler mechanism. Silver plated contacts and terminals. 250V/3.
Dimensions: Panel hole 19.2mm, overall length 37mm, length from rear of front shroud 30mm, supplied with 2 keys.

S 2515 $9.95
10 Up $9.10
S 2518 $2.95



Multipurpose Key Operated Switches

Dimensions:
Panel hole 19mm
Depth: 30mm from rear of front shroud, 36mm overall depth.
Diam: 22mm. Two keys supplied with each switch.

Two Pole Two Position
Key Removable in Position One Only
S 2502 $10.95
10 Up $9.95

Two Pole Two Position
Key Removable in Either Position
S 2504 $9.95
10 Up $9.45

Two Pole Three Position
Key Removable in Ctre. Position Only
S 2506 $10.95
10 Up 9.95

Two Pole Three Position
Key Removable in any Position
S 2508 $10.95
10 Up $9.95

Blank Keys for S 2500/10
S 2512 $1.20

Blank Keys for
S 2501 - 8 series
S 2513 $1.20

Flat Key Cam Lock

Zinc alloy die-cast housing with stainless steel cap. Key removable in either position. Disc tumbler cylinder. Solid brass keys (two supplied).
Dimensions: Panel hole 18.8mm, length from rear of front shroud to cam lever 16mm.

S 2550 $4.95
10 Up $4.75

S 2552 Spare Key Blanks
$1.20 ea

Piezo Alarms, Sirens & Buzzers

Piezo Alarm

Similar to "Sonalert" type. Absolutely ear piercing sound. Recommended voltage 5-15V DC. Ideal for almost all audio signalling applications, i.e. fire, water and gas signalling, computer alarms, etc.

S 5166 $7.95
10 Up $7.50

Panel Mount Piezo Buzzer

S 5168
$4.95
10 Up $4.50

This highly efficient piezo buzzer delivers 95dB and can be conveniently mounted on panels. Input voltage 5-15V DC 15mA.
Dimensions: 24.5 H x 29.5 D with 18mm panel hole for mounting.

Micro Piezo Siren

Massive 110dB operates from 6-12V DC 150mA.
Dimensions: 39 x 43 x 50mm

S 5170 $24.95
10 Up $22.75

Two Tone Piezo Siren

Commercial/Industrial Type. High efficiency SPL/100dB 12V DC 200mA. Two tone pulsating signal. Mounting flange allows wall or chassis mounting.
Dimensions: 85 Diam. 50mm H.

S 5175 $24.50
10 Up $22.75

Unobtrusive Indoor Wall Mount Piezo

High energy/efficiency type with loud (SPL 102dB) yet bearable 2 tone warble signal. Eminently suited to indoor wall mount applications, e.g. security, gas warning, electrical, water alarm system.
DC input 6-15V at 190mA.
Dimensions:
105x105x45mm.

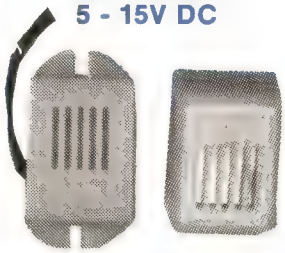
S 5178 $23.50
5 Up $21.50

High Energy Siren With Swivel Bracket

Absolutely ear splitting SPL 120dB. Handy bracket for wall mounting etc. 12V 300mA.
Ideal for industrial applications (or for home systems where the nearest neighbour is some distance removed!!)
Dimensions: 100mm Diam. 125mm L

S 5177 $29.95
4 Up $27.50

Mini Buzzer 5 - 15V DC



Handy little solid state low current buzzer is ideal for use with signalling panels, alarms systems, in the car, etc. Polarity conscious.
23 L x 17 H x 15mm W.

S 5162 $2.50

PBC Mount
S 5164 $2.95

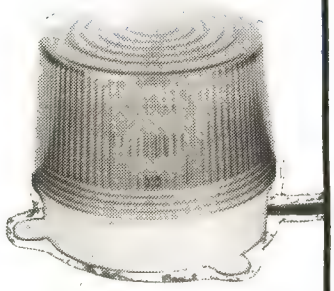
PHONEORDER TOLL FREE 008 999 007

Weatherproof Horn Speakers 10 Watt/8 Ohm

When driven with a square wave oscillator as commonly used in many alarm system panels, this horn speaker will deliver in excess of 120dB of sound pressure.
Enough to drive off any would be thief and alert neighbours.

C 2015 $15.95
6 Up $14.80

Strobe Signal Lamps



Uses Xenon Strobe tube for high energy flash output at a rate approx. 1 per second. Fantastic light energy output for the DC power used. DC input 12V 320mA.
Dimensions: 97 diam 50 H.
Two colours available.

S 5455 Blue $34.95
10 Up $32.95
S 5450 Red $34.95
10 Up $32.95

Alarm Stickers

200mm x 75mm
S 5400 $1.95
70mm x 25mm
S 5410 $3.95

Alarm System Sensors

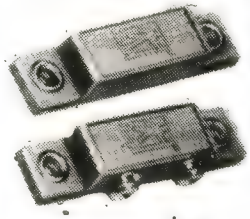
Ultrasonic Transducers

Ultrasonic transmitter and receiver transducers operating at 40kHz +/- 1kHz. Perfect for security applications etc., i.e. alarm sensors, counting sensors, remote control sensors and many other uses.
Sensitivity: TX 106dB RX 65dB
Dispersion angle: 20 deg.
Max Input Voltage: 20V RMS
Impedance: TX 500 Ohms RX 30K Ohm
Operating range: Upto 9M
Please Note: Only sold as matched pairs of RX, TX.
D = 16mm
H = 12mm

S 5110 $11.50 pr

Reed Switch and Magnet Sets

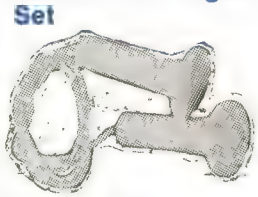
3 types (surface mount)



S 5153 SPDT $7.95

Changeover type
S 5155 N/C SW $7.95
S 5156 N/O SW $7.95

Concealed Reed Switch and Magnet Set



Simply brilliant!
Just drill recess your door or window and the magnet is flush mounted and thus 'invisible'. The Reed Switch segment is similarly mounted into the door frame or window frame and wired into your system. Can't be tampered with. Professional quality.

S 5152 $6.95
10 Up $6.45

Alarm Tamper (Pin) Switch

Low cost spring loaded switches simply make to frame (or earth) when pin is released.

52mm L **S 5145 $1.00**
10 Up $.90

65mm L **S 5147 $1.10**
10 Up $1.00

Alarm Circuit Window Foil Tape

S 5180 $25.95
10 Up $24.50

Tape Terminating Blks.

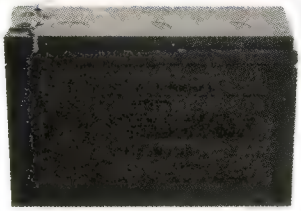
S 5182 $1.95
20 Up $1.45

Pressure Mats

Ultra thin switch mat for under carpet or mat etc.

S 5184 $29.95
10 Up $27.95

Backup Batteries



Premium grade long life. Sealed lead acid batteries. Ideally suited for security alarm panels.

S 5065 12V/1.2AH **$29.95**
S 5067 12V/3AH **$36.50**
S 5069 12V/4AH **$49.50**
S 5070 12V/6.5AH **$55.00**

Security Cable

4 Core

Professional grade multistrand security cable as used by the security industry.
4 inner conductors of 14/.20 copper wire — yellow, green, red, blue.
Three outer sheath colors to suit any installation — grey, black, white.

Grey W 0354
Black W 0355
White W 0356
80¢/metre $139.00/roll

Screened 4 Core

100% Mylar shielded cable with drain wire. 4 inner conductors of 14/.20 copper wire — red, black, white, blue, grey outer sheath. Ideal for use with P.I.R., siren strobes etc.

W 0705 $1.40/m
$1.15/10m

Telephone Cable

Two and three pair telephone cables, cream sheath with .5mm copper conductors.
Ideal for use with low current drain components where voltage drop is not a consideration.
Ideal for use with P.I.R.'s reed switches etc.

2 pair W 0302 .60¢/m
$78/200m roll
3 pair W 0303 .80¢/m
$100/200m roll

For further details on these and other cables turn to Wires and Cables section of this catalogue.

Alarm Contractors, Security Companies and bulk Users. Contact our Wholesale Company Altronic Distributors (08) 328 2199 for prices on bulk quantities.

PHONEORDER TOLL FREE 008 999 007

CB RADIO SAVES LIVES

Fit A CB To Your Off-Road Vehicle or 4 Wheel Drive Today

Uniden Budget AM 40 Channel

C 9610 **$139**

Great for short range communications e.g. up to 10km. A deluxe super-compact CB Transceiver. Incorporating latest surface mount technology, superior dual conversion receiver and Uniden's own state-of-the-art PLL designed circuitry to assure ultra-crisp communications.

Specifications:

Channels: 40 AM. **Frequency Range:** 26.965 to 27.405MHz.
Input Voltage: 13.8 VDC nom (+/- ground).
LED Meter: Indicates relative RF output and received signal strength.
Sensitivity: 0.5uV for 10dB; (S+N)/N typical (limit: 11.0uV).
Image Rejection: 80dB typical.
I.F. Frequency: Double Conversion Superheterodyne - 1st 10.692MHs - 2nd 450KHz.
Squelch: Adjustable: threshold less than 1uV.
Internal Speaker: 16 Ohms, 3 watts round.
Power Output: 4 watts.
Output Impedance: 50 Ohms unbalanced.

Uniden Long Range Single Side Band/AM

C 9620 **$369**

Range up to 80km during daylight and many 100's of km's with "skip" skywave propagation.

Super compact Design. The uniden SSB/AM represents the most advanced mobile type radio ever designed for use in the Citizens Band Radio Service. It will operate on any of the 40 AM frequencies and Upper and Lower Side Band Frequencies designated by the Department of Communications. It features a frequency synthesizing circuit with Phase lock loop techniques to assure precise frequency control.

Specifications

Channels: 40 AM, 40 USB, 40 LSB. **Frequency Range:** 26.965 - 27.405MHz. **Input Voltage:** 13.8 VDC nom (+/- ground). **Size:** 6" WW x 7.5" D x 2" H. **LED Meter:** Indicates relative power output and receive signal strength. **Sensitivity:** SSB - Better than .25uV for 10dB; (S+N)/N @ greater than 1/2 watt of audio output, AM; Better than .5uV for 10dB; (S+N)/N @ greater than 1/2 watt of audio output. **Squelch:** Adjustable; threshold less than .5uV. **Clarifier:** +/- 1.5KHz. **Internal Speaker:** 16 Ohm, round. **PA System:** 3 watts in external 8 Ohm speaker. **Power Output:** AM 4 watts, SSB 12 watts P.E.P.

Uniden Sundowner UHF Mobile FM transceiver

C 9630 **$499**

Glorious Noise Free UHF CB

Superbly engineered 40 channel UHF transceiver.
Features: Controls - volume, squelch, duplex repeater, tone squelch. Optional Selcal and CTCSS Facility and Tone Call.

Specifications

Frequency range: 476.425 MHz to 477.400 MHz. Repeater use (CH-1 to CH-8, TX only) 477.175 MHz to 477.350 MHz.
Power Source: 13.8V (DC). ● **Carrier Power:** 5W. ● **Sensitivity for 20dB S/N** 0.5uV. ● **Maximum Audio Output Power:** 3W. ● **Squelch Sensitivity at Threshold:** 0.5uV.

5 Watt UHF 40 Channel CB Transceiver

One of the most compact hand-held units to come from the UHF stable, the Roadrunner 5W Hand-Held weighs in at just 470gms - including battery pack.

Features:

- 5 watts Audio Output Power
- 40 Channels
- Squelch Control
- Power Hi/Low Key
- Press-to-talk Microphone
- LCD Displays
- Channel UP and DOWN Keys
- Channel Scanning
- Repeater Channel Programming
- Battery Charger
- One Year Warranty

C 9650 **$799**

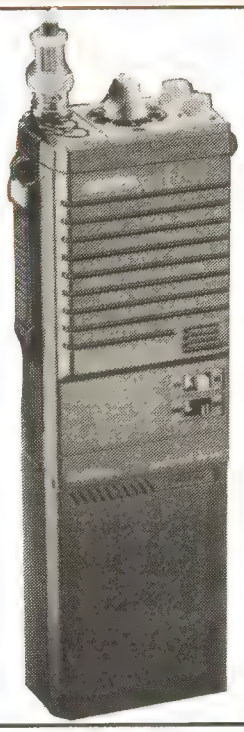
PHONEORDER TOLL FREE 008 999 007

Uniden 27 MHz 40 Channel Hand-Held Transceiver

The Uniden 27 MHz 40 Hand-Held is a completely self-contained 40 channel CB tranceiver built into a microphone. All of the most desirable features are right on the microphone including LED display, instant Channel 9, channel up/down keys and volume and squelch control. **And its snap-on battery pack gives you full CB power whenever and wherever you need it.** A telescopic magnetic mount antenna, 16" coaxial cable and carrying case complete the package. Includes two-year warranty.

C 9615 **$195**

1.5 Watt UHF 40 Channel CB Transceiver



For the person who cannot be tied to a vehicle the C 9640 improves your mobility and keeps you in touch.

Features:

- 1.5 Watts Audio Output Power
- 40 Channels
- Squelch Control
- Duplex/Simplex Switch
- Power Hi/Low Switch
- Press-to-talk Microphone
- DC Power Jack
- Channel Lamp Switch
- One Year Warranty
- Optional Selective Call

C 9640 **$599**

Uniden 10 Metre Amateur Transceiver

C 9710 **$649**

The Uniden Mobile has been designed using the latest state of the art electronics to give you years of trouble free service and is considered by many to be the finest 10 metre mobile transceiver available. Complete with USB/LSB/AM/FM operation, scanning operation, noise blanker, TX switch and RIT control. Tomorrows technology is here today. This high powered, high profile mobile transceiver comes complete with all the hi-tech features desired in a 10 metre Amateur Mobile Transceiver.

Multifunction Meter
Indicates mode of meter function modulation S/RF/SWR etc.

Noise Blanker (NB)
Greatly reduces electrical interference from ignition or other engine component.

PA Switch
Allows selecting the Public Address mode if an external PA speaker is installed.

RF Gain
Adjusts receiver sensitivity for clear reception of strong and weak signals.

TX and RX LED's
Light to indicate when the unit is transmitting (red) or receiving (green).

Seven Watt Audio Output
Enhanced audio circuit boosts volume above ambient noise conditions for clear reception.

Squelch Control
Adjusts the threshold of the receiver to eliminate background noise whenever a transmission is not being received.

S/RF Meter (illuminated)
Accurately shows a reading of signal strength when receiving and RF ouput when transmitting.

SWR Control
Allows you to test your antenna system for best performance.

Tone Control

SUPPRESSORS

Lead Suppressor

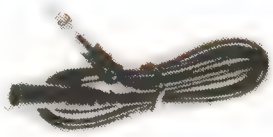
Connect anywhere in the HT to eliminate or reduce ignition noise. Simply cut centre (coil) distributor wire and screw cut ends into suppressor.

C 9510 **$1.95**

Capacitor Noise Suppresser

C 9520 **$3.95**

FM/AM Aerial Extension Lead 1.2M



P 0463 **$4.95**

Coax Alternator Supressor

Heavy duty 0.5uF 50 volt coaxial capacitor for extreme cases of alternator whine. Connect in series with the output lead of the alternator and earth the case. Will handle 60 amps.

C 9525 **$24.95**

Hot Line Noise Suppression Kit

For alternator and ignition noise suppression.

C 9530 **$13.95**

GENERAL PRODUCTS

27MHz CB Antennas

5′ Whip
Fibreglass helical whip with standard chrome brass ferrules. 5/16″ threat 24 tpi female thread.

L 3200 **$14.65**

5′ Tuneable Whip
Sturdy PVC covered helical whip with easily tuneable top whip 120mm long. Standard 5/16″ threat 24 tpi female thread.

L 3205 **$29.50**

Fully Assembled Whip Lead & Base
The L 3200 helical ship antenna, and a 12′ coax lead fully soldered to an L 3220 base. Ready for immediate installation.

L 3210 **$34.75**

Standard Base
5/16″ male fitting, low profile design.

L 3220 **$3.95**

12′ Lead and Plug
Antenna lead of RG58A/U cable with a PL259 plug one end, and stripped and fitted with terminals to the other.

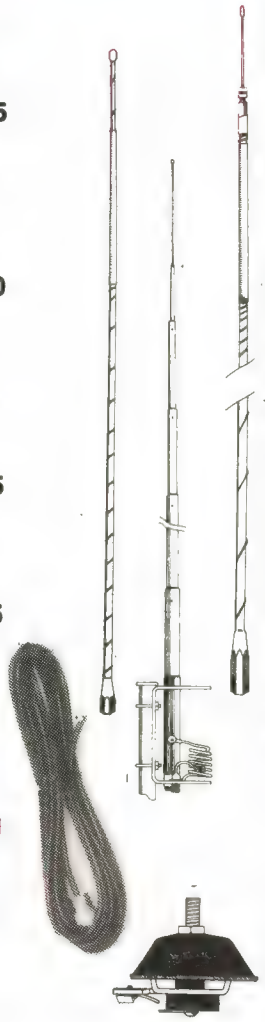
L 3225 **$13.95**

Heavy Duty Tension Spring
Ideal for use with the L 3200 and L 3205 Antennas 5/16″ thread.

L 3230 **$27.95**

UHF Antenna
4.5dB gain 61cm whip complete with base, lead and connector.

L 3212 **$34.75**



Base Antenna
An extra wide bandwidth base antenna without ungainly size. Supplied with a fully pretuned and assembled DC grounded matching system and all mounting hardware. Waterproofed and usable with any length coaxial cable at any height above the ground, earthed or unearthed.

Specifications:
Impedance 50 Ohm • **V.S.W.R.** 1.3:1 • **Polarization** Vertical • **Termination** S0239 • **Height** 5.6m • **Wind Survival** 130m/H • **Power** 1kW

L 3215 **$119.00**

Fully Automatic Aerial
Extends automatically when ignition is turned on. Retracts similarly when turned off. Full kit includes all accessories and fixings. Full instructions included.

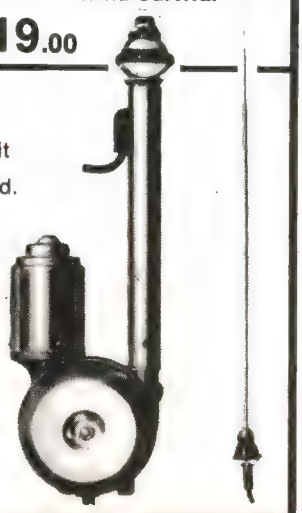
C 9420 **$49.95**

Lock Down Aerial
Stainless Steel 1.5mm extended length. Supplied with 3 keys.

C 9405 **$9.95**

Spring Base Aerial
Heavy Duty Stainless Steel 1.5M extended length.

C 9410 **$12.95**



Batteries

Long Life Alkaline
4-6 Times the life of normal zinc carbon batteries.

Cat No.	Pack/Size	Price
S 4950	2 of D	$5.50
S 4960	2 of C	$4.95
S 4970	2 of AA	$2.90
S 4985	2 of N	$3.40
S 4990	1 of 9V	$4.50
S 4995	1 of 12V	$3.50

Heavy Duty Zinc Carbon/Zinc Chloride Batteries

Cat No.	Pack/Size	Price
S 4920	4 of AA*	$2.50
S 4930	4 of AAA*	$2.50
S 4940	2 of 9V	$2.50

* Note that the AA and AAA size batteries are Zinc Chloride. These are a new breakthrough in battery technology — they deliver approx. 75% of the performance of Alkaline batteries — for only about 1/3 of the price!

Battery Holders

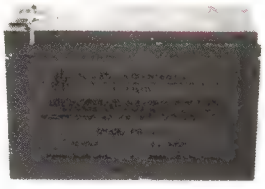
		Each	10+
S 5025	2 x AA Cells	.60	.55
S 5028	4 x AA Cells Long	1.00	.90
S 5030	4 x AA Cells Flat	.90	.80
S 5031	4 x AA Cells Square	.90	.80
S 5032	6 x AA Cells	1.00	.90
S 5034	8 x AA Cells	1.40	1.20
S 5035	10 x AA Cells	1.75	1.60
S 5036	4 x C Cells	1.50	1.25
S 5038	4 x D Cells	1.60	1.45
S 5046	1 x D Cells	.75	.65

Nicad Rechargeable batteries

Premium Grade — Good for up to 1000 re-charges. Charge Rate 45-50mA for AA, 20mA for AAA, 10-15mA for 9V 120mA.

Cat No.		1-9	10-99	100 Up
S 5020	AA 1.2V 500mAh	$3.99	$3.25	$2.95
S 5021	AAA 1.2V 180mAh	$4.50	$3.95	$3.60
S 5022	C 1.2V 1.8Ah	$12.00	$10.50	$9.50
S 5023	D 1.2V 4Ah	$19.50	$18.00	$16.00
S 5024	216 9V .12Ah	$18.95	$17.85	$16.10

Sealed Lead Acid Batteries



As used in security systems, battery backup for computers, solar power systems etc.

Premium Grade Long Life (Typically in excess of 5 years) Easy to Charge.

S 5065	12V/1.2AH	$29.95
S 5067	12V/3AH	$36.50
S 5069	12V/4AH	$49.50
S 5070	12V/6.5AH	$55.00

Button Calculator and Watch Batteries

Silver Oxide	Hitachi Maxell	Eveready	National	Price
S 5000 G13	SR44	396		$3.45
S 5002 G12	SR43	392	WL1	$2.75
S 5004 G10	SR1130	393	WL6	$2.95
S 5006 G8	SR1120W	391	G8	$3.45
S 5008 G5	SR48	289	WL10	$2.95
S 5010 G3	SR41	386	WL11	$3.45
S 5012 G2	SR726	357	WL14	$3.95
Alkaline				
S 5014	LR44	A76	LR44	$2.25
S 5016	LR43	186	LR43	$2.25
S 5018	LR1130	189	LR1130	$2.25

PHONEORDER TOLL FREE 008 999 007

High Power Car Alarm

With Wireless Remote Control

DIRECT IMPORT PRICE

With features which normally come only with expensive alarms, this alarm offers exceptional value for your money!

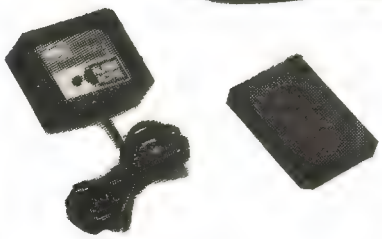
Audible warning with a 125 decibel loud siren and visible warning of flashing headlights when the alarm system is triggered.

Automatic remote control
Keyring remote control allows arming with 'beep' sound and disarming with a headlights flashing signal.

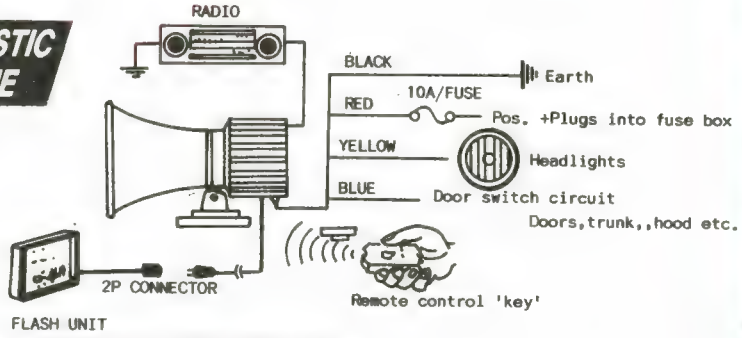
High performance
The alarm system will be triggered by unauthorised entrance through the car doors, boot, bonnet or removal of the car sound unit. The siren will sound and the headlights flash for 60 seconds.

Simple wiring
Without professional technician's assistance you can do the wiring yourself.

Automatic reset



FANTASTIC VALUE



S 5220 Value Plus $99.00

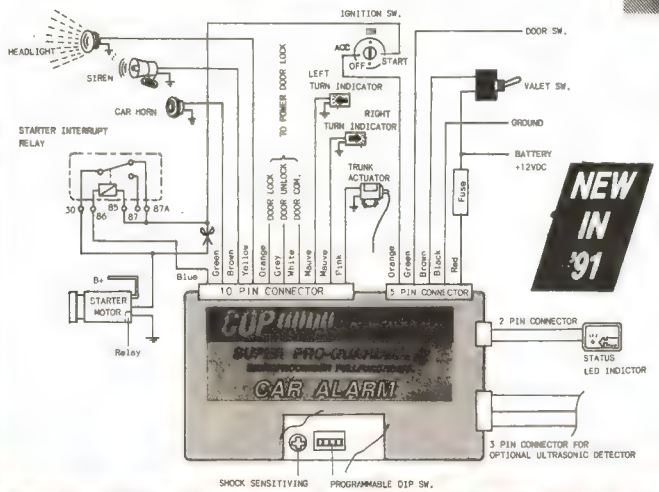
Micro-Processor Controlled Car Alarm

Super new model designed to help stop your car from becoming a statistic.

A host of features is made possible by utilizing latest technology techniques.

JUST TAKE A LOOK AT THE LIST OF FEATURES!

- Multi-function keyring remote control.
- Built in shock sensing.
- Starter inhibiter.
- Car location facility - chirps car horn during the day, flashes lights at night, all via remote control.
- Emergency panic facility immediately sounds siren once activated by remote.
- Boot release can be remotely operated (where fitted).
- Central door locking interface enables doors to be locked/unlocked simultaneously when alarm is armed/disarmed via remote (where fitted).
- Remote transmitter utilises 'Saw Resonator' circuitry for optimum frequency stability.



NEW IN '91

- EEPROM coding on transmitter and receiver enabling 50,000 different codes for high security.
- RF lockout safety system eliminates the possibility of accidental activation of alarm while vehicle is driven.
- Using the slide switch on the transmitter, one control unit can operate two cars, making it ideal for multi-car families.
- Switchable 'chirp' confirmation when alarm is armed/disarmed.
- Programmable remote exit delay (5-30 seconds).
- Automatic arming mode — effective when last door is closed.
- Valet/override switch for valet parking or when vehicle is serviced.
- Alarm will reset after 60 seconds if tripped.

FANTASTIC VALUE AT ONLY

S 5230 $199.95

PHONEORDER TOLL FREE 008 999 007

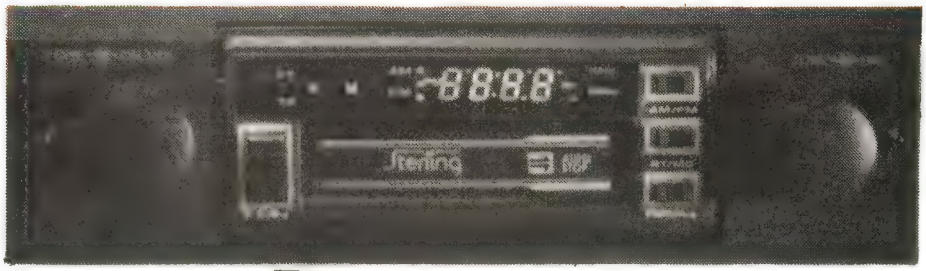
RADIOS

Stereo Car Radio with Auto Stop Cassette Player

With Electronic Tuning Radio and Digital Display

DESCRIPTION

- AM/FM MPX stereo receiver
- Special short chassis 178W x 44H x 125D mm
- Digital frequency display
- Full night illumination
- Stereo cassette player
- Locking fast forward
- LO/DX AM/FM recall function
- Separate balance/tone control
- In-dash auto stop tape function
- Manual radio tuning control
- Digital clock



NEW FOR '91

C 9120 **$139.00**

AM/FM Stereo Car Radio Cassette Player

Superb new model car stereo from Sterling. Flat face monitoring with 30 station memories. Night illumination and big LCD display make this the perfect choice for your car.

DESCRIPTION

- ETR AM/FM/MPX flat nose digital receiver
- LCD digital display & quartz clock
- Auto stop tape function
- Preset scan/auto store
- Station memory program search
- Night illumination
- 30 station preset (18FM/12AM)
- Pushbutton controls for up/down channel tuner
- 4-way fader control
- PLL synthesizer tuner
- Chassis 178(W) x 50(H) x 150(D)
- IAC noise reduction

NEW FOR '91

C 9125 **$209.00**

Latest top of the range car radio cassette with CD input

Auto Reverse Car Radio Cassette Player

With Electronic Tuning and Digital Display

The ultimate receiver for your auto. Massive 25 watts per channel of pure audio fidelity. Pre-set push button electronic tuning with memory.

DESCRIPTIONS:

- ETR-AM/FM/MPX flat face digital receiver
- High power 50 watts
- LED digital display, digital quartz clock
- Auto reverse tape function
- Locking fast-forward rewind
- Loudness button
- Preset scan/auto store
- Station memory program search
- Night illumination
- CD auxilliary input
- Separate treble slide control
- Separate bass slide control
- 30 Station preset (18FM/12AM)
- PLL synthesizer tuner
- 4-Way fader control
- Pushbutton controls for up/down channel tuner
- RCA line level outputs for use with optional amplifier
- Chassis 178(W) x 50(H) x 150(D)
- IAC noise reduction

NEW FOR '91

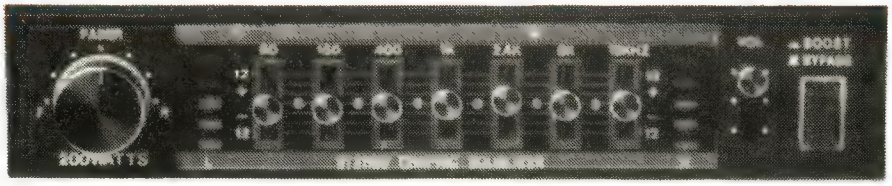
C 9128 **$329.00**

PHONEORDER TOLL FREE 008 999 007

7 Band Graphic Equalizer/Booster

DESCRIPTION

- 7-Band graphic equalizer
- 12dB boost/cut
- Power on/off-defeat
- 2-channel high power amplification
- Two or four speaker hook-up
- 100 watts RMS, 2 x 50 watts
- 200 watts max, 2 x 100 watts
- Dual LED power meter display
- Fader control
- Volume slide control
- Night illumination around all controls
- Input impedance: High 47K Ohms via RCA jacks. Low 100 Ohm
- Common or floating ground hook-up
- Frequency response: 20Hz-20kHz
- Output impedance 4 Ohms, (4-8 Ohm allowable)
- Slimline design
- Dimensions: 150L x 30H x 144W mm



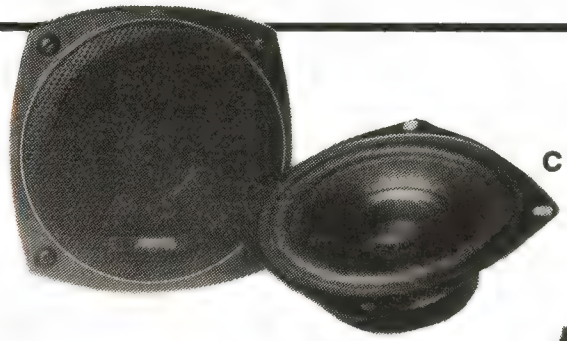
C 9140 **$99.95**

NEW IN '91

30 Watt Flush Mount

DESCRIPTION

- High performance 4" dual cone
- Power handling 30 watts max
- 4 Ohms impedance
- Hi-grade barium magnet
- Frequency response 90 to 18,000Hz
- Ideal for door or kick panel mount
- Complete with wire and hardware
- Dimensions: 48D x 109W mm



C 9327 **$34.95**

NEW FOR '91

3 Way 40 Watt Flush Mount

DESCRIPTION

- 5" 3-Way slimline speaker system
- Power handling 40 watts max
- 4 Ohms impedance
- Hi-grade 5oz barium magnet
- Ideal for shallow mounting locations
- Dimensions: 45D x 142.5W mm
- Steel mesh grill for easy mounting
- Mounts in front kick panel, doors side panels and rear deck
- Frequency response 140 to 20,000Hz
- Complete with wire and hardware

C 9328 **$59.95**

4 Way Bass Reflex Wedge Speakers

DESCRIPTION

- High performance 4-way bass reflex speakers
- Power handling 100 watts max
- 4 Ohms impedance
- High impact heat resistant case
- Surface mount enclosure
- 5" Air suspension woofer
- Frequency response 60 to 21,000Hz
- Complete with wire and hardware
- Dimensions: 322W x 136H x 175D mm

C 9340 **$119.95**

FANTASTIC VALUE

160 Watt 6"x9" Triaxials

DESCRIPTION

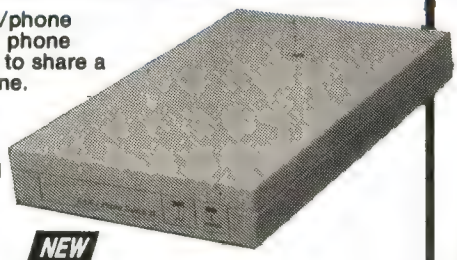
- High performance 6"x9" 3-way speaker
- Power handling 160 watts max
- 4 Ohms impedance
- Poly carbon mica coated cone
- Dome tweeter
- Hi-grade barium ferrite magnet
- Frequency response 50 to 22,000Hz
- Complete with wire and hardware
- Dimensions: 244W x 170H x 111D mm

C 9334 **$139.95**

TELEPHONE PRODUCTS

Fax/Phone Auto Switch

Eliminates Dedicated Fax Lines



This automatic fax/phone switch allows your phone and fax or modem to share a single telephone line.

Fax/phone switch automatically distinguishes between voice and data signals, switching calls to the telephone, fax or modem. No buttons to push or fax calls to transfer.

NEW IN '91

A 0800 **$299.95**

- **Incoming Calls** - The fax/phone switch instantly senses an incoming call and says to the caller "To reach our phone, say 'telephone' at the tone. To reach our fax, please remain silent". The incoming signals are then analysed and determined to be silence or a fax/modem tone or speech. When the ring is answered, the switch connects the incoming line to the appropriate device.
- **Outgoing Calls** - The switch senses whether the phone or fax/modem goes off-hook and immediately connects that unit to the phone line.

Fax/Telephone

Automatic Switching Device

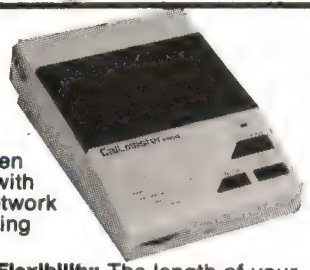
NEW IN '91

NOT AUSTEL APPROVED

Similar function to the above unit. At time of printing this device has not been allocated an approval number for connection to the Telecom network.

A 0810 **$99.00**

Callmaster Answering Machine



CALLMASTER 2600 has been designed for compatibility with the Australian telephone network and incorporates the following features:

Outgoing Message (OGM) Flexibility: The length of your OGM can be varied; CALLMASTER automatically inserts tone sound on completion of OGM.

Variable Incoming Message (ICM) Length: The ICM is voice controlled; CALLMASTER stops recording when caller 'hangs up' or at a maximum length of 60 seconds.

Monitoring A Telephone Call: Listen to ICM over in-built loudspeaker and decide to intercept personally or let CALLMASTER complete recording of message.

Rapid Erase: Avoids confusion by eliminating old messages.

Toll Saver: CALLMASTER will advise, before answering, of any new incoming messages, time and money saving when calling CALLMASTER via STD or ISD, to retrieve your messages remotely.

Remote Playback: Your recorded ICM's can be remotely replayed via phone anywhere by using A 0505 remote.

If an appropriate tone phone is available, this can be used instead of the remote control.

Telecom: Permitted for direct connection to the telephone network. You just plug it in! Telecom Authorisation C89-16A-106.

A 0500 Model 2600 CALLMASTER **$149.00**

A 0505 Remote control **$55.00**

Callmaster Cordless Telephone

NEW FOR '91

The Callmaster CT 880 is a brand new item in our 1991 range. It is certainly not cheap, nonetheless it is far and away the best performing cordless phone we've ever appraised. Good clear reception up to 200 metres in open conditions and most importantly — loud and crisp audio, just like a normal wired phone, now that's a great improvement on all those "el cheapo" cordless phones our competitors sell.

THIS SUPERB NEW MODEL FEATURES:

• Full 2 way Intercom and Paging • 3 Way Conversations • Take Call from Handset or Base • Tone/Pulse Switchable • Hands free facility on base • 2 Channels • Dual Security Systems • Auto Battery Charging • Last Number Redial • Mute Function • Hi-Lo Handset Volume Switch • Optional Remote Handset Charger Available • Telecom Authorised • Department of Communication Authorised.

You'll never have to run for the phone again. The CALLMASTER CT-800 AUS cordless telephone allows you to make or receive calls up to 200 metes from the base, depending on environmental conditions.

The CALLMASTER CT-800 AUS is one of the most advanced cordless telephones available, utilizing the approved frequencies, sophisticated digital security and a channel selector switch to help ensure trouble-free operation. The ability to answer calls at either the handset or base station locations is unique.

A 0340 **$299.00**

Push Button Telephone

With memory Re-dial. Great for use as a 2nd phone around the house or office. This nifty little phone has all the features of units selling near twice the price!

Last number re-dial memory and mute key.

Ring, on/off switch and dialing indicator.

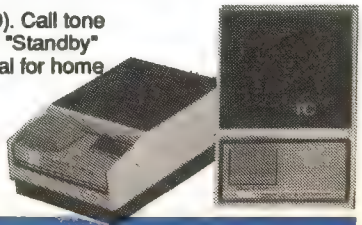
A 0490

$19.95

Comes fitted with standard telephone plug.

Two Station Intercom

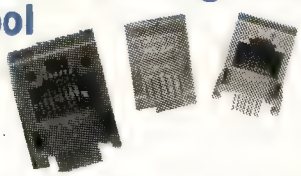
Battery operated (9V S 4940). Call tone from either station in "Off" or "Standby" mode. Clear crisp audio. Ideal for home or office.



A 0470 **$34.95**

PHONEORDER TOLL FREE 008 999 007

Standard U.S. Modular Sockets, Plugs and Crimp Tool



See wire cables section for cable to suit.

PCB Mount Sockets		ea.	10 Up
P 1402	4 Way/4 Wire	$1.95	$1.85
P 1405	6 Way/6 Wire	$2.75	$2.65
P 1408	8 Way/8 Wire	$3.85	$3.75

Crimp Type Plugs		ea.	10 Up
P 1412	4 Way/4 Wire	$.55	$.50
P 1414	6 Way/4 Wire	$.55	$.50
P 1415	6 Way/6 Wire	$.65	$.60
P 1418	8 Way/8 Wire	$1.50	$1.35

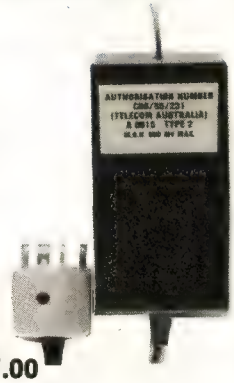
Modular Connector Crimping Tool

Deluxe type assures fast, easy attachment. Durable steel construction. Built-in cutter, stripper and crimper. Suits all crimp style plugs opposite.

T 1560 **$39.95**

Telephone Line Isolation Units

All Telecom Approved



Type 1. Designed to interface paging output of PABX or Commander phone systems to public address amplifier. Connects to aux. input

A 0610 **$99.00**

Type 2. Provides 'music on hold' (M.O.H.) to your Commander phone system. Program input can be radio, tape deck, landline etc. Max output 800mV P-P. Suits 'SB' Commander

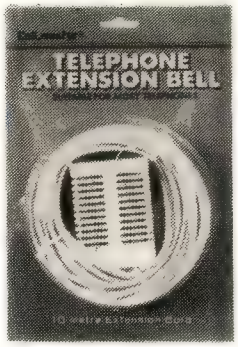
A 0615 **$99.00**

Type 3. Similar to type 2 (A 0615) excepting max output is 2.8V P-P. Suits Series 'S' Commander A 0620 **$99.00**

Telephone Extention Bell

Connects via P 0995 double adaptor to telephone line. NOT SUITABLE FOR COMMANDER PHONE SYSTEMS.

P 0996 **$29.50**



Telephone Pickup

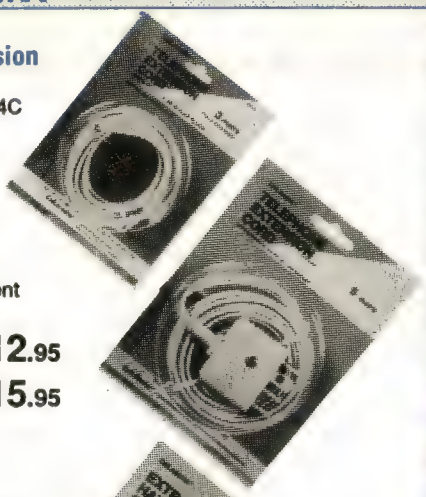
Handy for espionage agents and for connecting to telephone amplifiers.

A 0485 **$2.95**

Telephone Extension Cord

US modular type 6P4C plugs, 3m length.

P 0989 **$9.50**



Extension Cord

Available in convenient lengths.

5m P 0990 **$12.95**

10m P 0992 **$15.95**

Telephone Handset Extention Cord

US modular 4P4C plugs, 5m length.

P 0993 **$11.25**

Conversion Cord

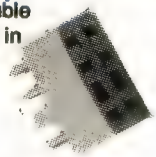
Changes from American modular plug, now common on imported equipment, to an Australian plug. 2m length.

P 0994 **$9.50**

Telephone Double Adaptor

Converts socket into a double socket to allow you to plug in two phones.

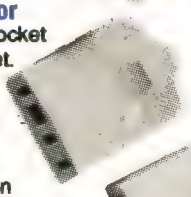
P 0995 **$4.95**



Telephone Adaptor

AUSTRALIAN line socket to US modular socket.

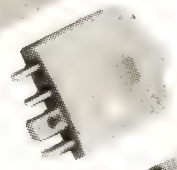
P 0999 **$6.95**



Adaptor Plug

Converts an American modular plug into an Australian plug.

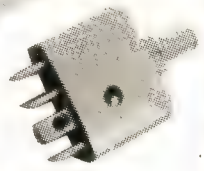
P 0998 **$4.95**



Australian Telephone Plug

Standard telephone plug.

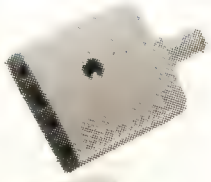
P 0985 **$3.75**



Australian Telephone Line Socket

Standard telephone socket in combination with P 0985 lets you wire your own extention cord to any length.

P 0987 **$4.35**

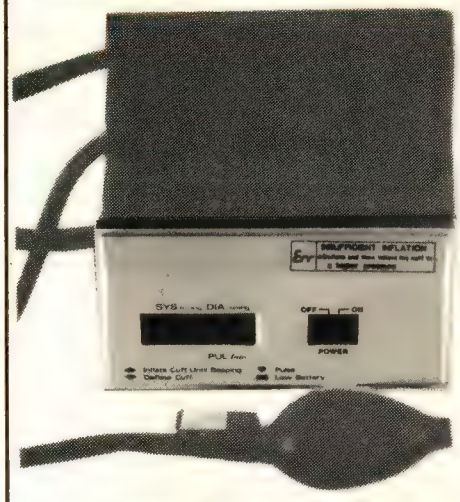


Australian Telephone Wall Socket

P 0988 **$5.50**

BLOOD PRESSURE MONITOR

Why Risk Unnecessary Heart Attack?
Blood Pressure and Heart Rate Monitor



Features:
- Non-Micro phone Measurement System.
- LCD Readout
- Blood Pressure Monitor
- Pulse Rate

EXTREMELY ACCURATE. MADE IN JAPAN.

Heart disease strikes down many people in their early 40's (or even 30's). The tragedy remains that had such victims been alerted, remedial medical, physical and dietary action could have been prescribed to avoid illness and in many cases restore full bodily health.

Monitoring the cardiovascular system of every member of your family is now an easy and affordable necessity with the X 3055 Digital Blood Pressure Monitor. A Built-in microcomputer and the microphone-free measurement system guarantee that all readings are highly accurate. The LCD panel shows readings in large numerals for confident masurements. Special symbols to guide you in operation and clear error messages make it easy for every member of the family to use the X 3055. A built-in miser circuit automatically shuts of power to conserve your battery if the unit is not switched off after use. Inflation by the conventional rubber squeeze bulb and deflation by the pre-settable valve make this unit familiar and easy to use daily. Put the X 3055 in your family's health plan - it's a modest investment in your invluable health.

Specifications

Measuring Method:	Oscillo-Metric Method
Measuring Range:	0-300mmHg Cuff Pressure 40-150 Pulse/Min. Pulse Rate
Accuracy:	Pressure+/- 3mmHg (confirmed A.A.A.M.I.) Pulse rate + 5% of Reading
Pressure Build-Up:	Squeeze Bulb
Deflation Method:	Pre-Settable Exhaust System
Exhaust:	Manual Valve

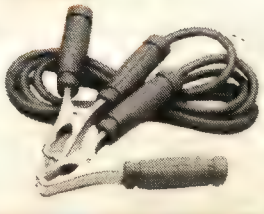
X 3055 **$119.00**

BUY ONE FOR DAD OR MUM

100 Amp Jumper Leads

These are the real McCoy. Extra heavy duty 100 amp capacity. Get a set for your car today.

A 3011 **$24.50**



Pin Point Ultrasonic Cle

Awarded the Good Product Design Awar CETDC in 1987. This fantastic Ultrasonic cleaner can earn its cost a hundred times over in cleaning Computer Connectors, PCB's, Switches, Relays, Jewellery, Glasses, Watches etc.

A 0100

$199.00

Ideal for cleaning drafting pens, watches, photographic filters, even dentures!

How Does It Work?

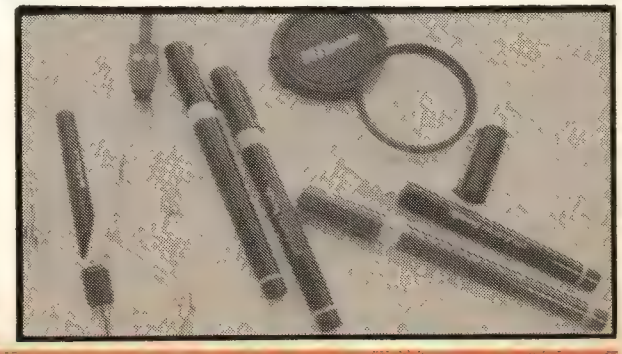
The Pin Point Ultrasonic Cleaner uses a transducer generator to produce millions of activated microscopic cleansing bubbles, which blow dirt, grease & grime off surfaces, and penetrates deep into cracks and holes.

This personal ultrasonic cleaner won't scratch precious jewellery or glass. Comparison studies made by hospitals, commercial businesses and industry show ultrasonic cleaning proves better and safer than any conventional method.

But don't take our word for it. Test the Pin Point ultrasonic cleaner yourself. Pop your dirty watches, glasses, connectors etc. into the cleaners stainless steel basin, add a cup of tap water, and three minutes later see the difference. The results are instantly revealing.

SPECIFICATIONS

Power Supply: 240V 50Hz
Power Consumption: 300mA
Frequency: 40 +/- 2KHz
Dimensions: 224 x 114 x 124mm
Capacity: 570ml
Weight: 1Kg
Body Material: ABS Plastic
Tank Material: Stainless Steel (SUS 304)
On/Off 3 Minute Auto Timer



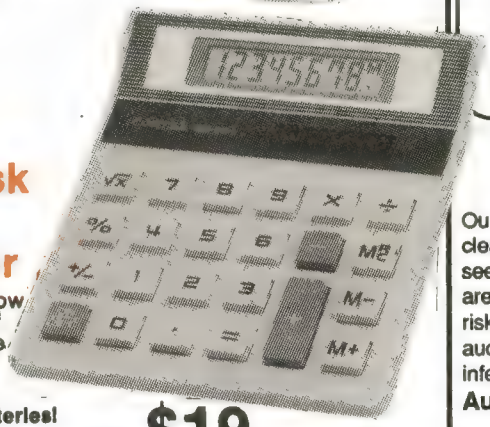
PHONEORDER TOLL FREE 008 999 007

Mini Desk Calculator With Extra Large Display

This fantastic little calculator has an angled display with extra large digits making it ideal for your desk. With rubber keys for positive feel. Has memory, square root and percentage keys. It even fits in your pocket.

X 2110 **$19.95**

Solar Powered Solar Desk Top Calculator



New technology now allows powering of large desk top type display as used with our X 1050.

No more leaky batteries!
No more batteries!

X 1060 **$19.95**

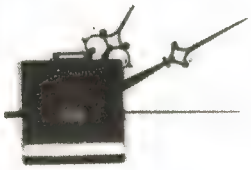
● 8-digit mini desk top calculator ● 3-key memory ● Percent key with add on/discount calculation ● Square root key ● Large PLUS key ● **Size:** 123 x 107 x 23.5mm ● **Weight:** 110g

Casio Two Colour Printing Calculator

Perfect for Home or Office

Superb new model features:
• Black print and red print for subtractions • Sub-total/total • Item counting • Average function • 3 digit comma markers • Full decimal system
Operates on 4xAA batteries (included) or power supply. Includes one roll of 58mm paper and dust cover. Fantastic for the student and accountant alike.

X 2125 **$149.95**



Clock Movement

Fit your own custom clock face. Great for novel applications such as fitting to pictures etc. Very accurate, runs for approx. 1 year on one AA battery.

X 1010 **$13.50**

Famous TDK Audio Cassette Tapes

		1-9	10 UP
A 4020	D60	$3.95	$3.50
A 4022	D90	$4.50	$4.20
A 4024	AD60	$4.95	$4.55
A 4026	AD90	$5.50	$5.15
A 4028	SA60	$6.50	$5.95
A 4030	SA90	$7.50	$6.95

Gentle Action Wet Type Head Cleaners

That Really Do A 100% Job

Our exciting range of head cleaners are the best we've seen and more importantly they are gentle on your heads. Why risk damaging your video or audio cassette player with inferior units.

Audio Cassette

A 9200 **$3.95**

VHS Video

A 9310 **$12.50**

Compact Disk Cleaner

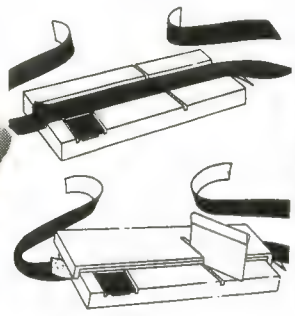
NEW IN '91

Gently cleans the CD. Eliminates problems caused by finger prints and some fine scratches. A must for the enthusiast.

A 9220 **$17.95**

Video Repair Kit

VHS/Beta



A VHS/Beta Video Tape Repair Kit. No need to throw out your damaged tapes - this nifty splicing kit can save you a fortune (if you've got small children this kit will save you several fortunes!)
All accessories included for joining tape and refixing leader ends etc.

A 9315 **$8.50**

Dubbing Set

Any video to any video
P 0730
$21.95

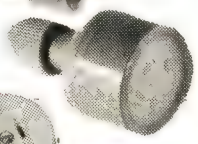
GENERAL PRODUCTS

Mains Lead

A 2400 7.5 Amp 1.8m $3.95
A 2405 10 Amp 1.8m $5.95
A 2410 IEC Power Lead 1.8m $9.85

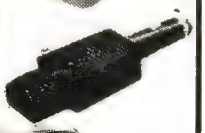
Mains Plug
P 8210 $1.80

Extension Lead Socket
P 8230 $5.95



Surface Mount Socket
P 8234 $ 4.95

IEC Mains Connector
P 8310 $1.95

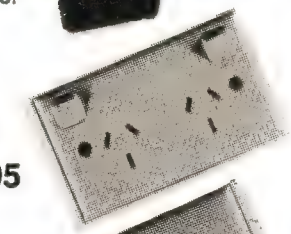


IEC Mains Chassis Socket
P 8320 $2.95

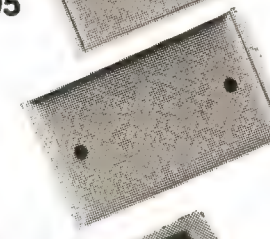
Mains Plug IEC Male Line
P 8328 $9.95

IEC Mains Socket With Fuse Holder
Holds M205 fuse plus a spare!
P 8324 $4.50

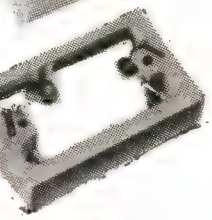
Power Outlets
P 8240 Single $7.25
P 8245 Double $11.95



Blank Plate
P 8040 $4.00



38mm Deep Mounting Block
P 8045 $2.95



13mm Deep Mounting block
P 8047 $2.50

Double Adaptor
P 8290 $3.75

Room Light Dimmers

500 Watt capacity - and that is an awfully bright room! Simply install in 5 minutes in place of normal wall or architrave switch. Fantastic for mood lighting the dining room or for the nursery.

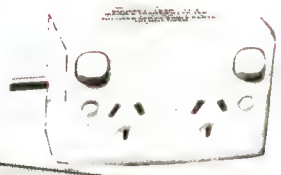
Standard Wall Box Type

A 1400 $16.95

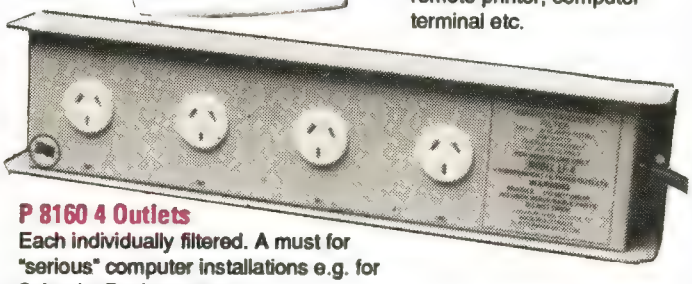
Architrave Type

A 1410 $16.95

SQUEEKY CLEAN MAINS FILTERS



P 8150 Single Filtered Double Outlet Model
Just the shot for home computer or for individually located peripherals e.g. remote printer, computer terminal etc.



P 8160 4 Outlets
Each individually filtered. A must for "serious" computer installations e.g. for Schools, Business etc.

CLEAN UP YOUR POWER ACT!

The supply authority actually superimpose a range of frequencies from 1KHz to over many MHz for the control of hot water systems, and other industrial remote control services.

Additionally both industrial and domestic motors turning off and on can induce large spikes into the mains supply.

For you to ensure maximum safeguard to both your hardware and software against RF noise, control tones and voltage spikes the equipment should be pre-filtered by a SQUEEKY CLEAN MAINS FILTER.

Most modern personal computers and their peripheral equipment are fitted with basic type filtering components.

In most instances this protection offers only minimal protection and is not capable of handling many mains supply problems.

Many unexplained errors, program corruption and general inconvenience are eliminated by a Squeeky Clean.

All SQUEEKY CLEAN filters are approved by the Energy Authority for connection to the electrical power circuits in all states of Australia, and are guaranteed for 12 months from date of sale.

SPECIFICATIONS: P 8150
Load Rating: 10 Amps Maximum Load at 240V AC
Clamping Voltage: 390V Peak or 275V RMS
Peak Impulse Current: 2000A (8 x 20u)
Protection Modes: Active-Neutral, Active-Earth and Neutral-Earth (on special order)
Earth Leakage: Will not trip a 20mA Earth leakage breaker.
Outlets: GPO's single filtered
Cable Length: 1m (approx.)
Dimensions: 120mm (L) x 75mm (W) x 50mm (D)
App. No. N10717

SPECIFICATIONS: P 8160
Load Rating: Continuous 10 Amps, with circuit breaker at 240V AC.
Clamping Voltage: 390V Peak or 275V RMS
Peak Impulse Current: 2000A (8 x 12u)
Production Modes: Active-Neutral, Active-Earth and Neutral Earth (on special order)
Earth Leakage: Will not trip a 20mA Earth leakage breaker.
Outlets: 4 GPO's individually filtered
Cable Length: 1m (approx.)
Dimensions: 435mm (L) x 100mm (W)x65mm (D) Metal Case
App.No. N10716

P 8150 $119.00
P 8160 $289.00

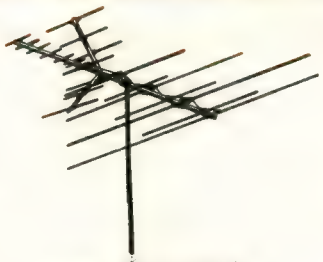
PHONEORDER TOLL FREE 008 999 007

VHF & VHF/UHF TV Antennas

Spiromatic Indoor Antenna

For good reception areas.
Channel 0 to 11

L 2018 **$9.95**



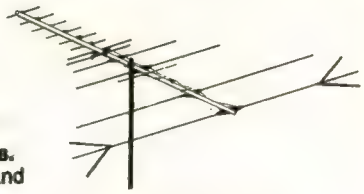
L 2012 **$108.00**

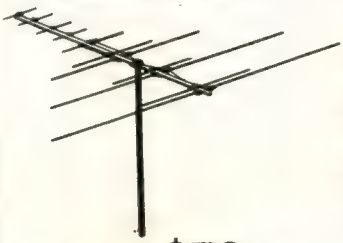
An excellent antenna for poor reception areas. Channels 0 to 11 VHF, FM & UHF Band 4 (including Channel 28) and also Band 5 UHF.

Economical VHF & UHF Antenna

L 2004 **$65.95**

For good reception areas.
Channel 0 to 11 VHF, FM and UHF Band 4
(including Channel 28).





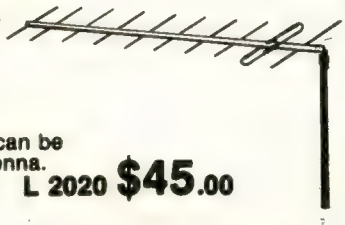
L 2008 **$72.00**

All new suburban antenna for average reception areas. Channel 0 to 11 VHF, FM & UHF Band 4 (including Channel 28).

New Ghostbuster VU

Extra UHF dipole added. Now has phase cancellation on UHF also. This unique design combines forward signals on both UHF dipoles whilst any signals from the rear are cancelled which provides a brilliant front to back ratio on VHF and UHF for bad ghosting areas.

L 2016 **$120.00**



UHF Antenna

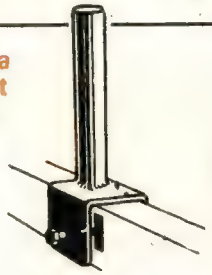
Channel 28 band 4 antenna can be coupled to existing VHF antenna.

L 2020 **$45.00**

TV Antenna Loft Mount

L 2030

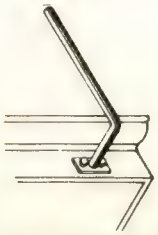
$9.95



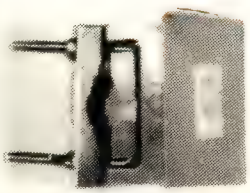
Antenna Facia Bracket

L 2035

$15.75



Outdoor Diplexer



Weatherproof coupler allows connection of VHF and UHF antennas into one down lead.

L 1404 **$11.50**

TV Baluns

TV Balun - Indoor

75 to 300 Ohms

L 1010 **$2.98**

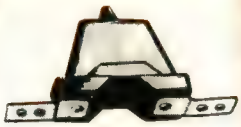
10 Up **$2.80**

TV Balun

300 to 75 Ohm

L 1012 **$2.30**

10 Up **$1.99**



Outdoor Weatherproof Balun

L 1020 **$4.50**

10 Up **$4.15**

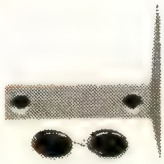
TV Outlets

TV Outlet Single Way

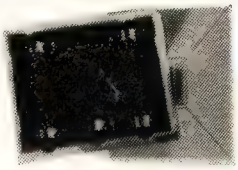
L 1030 **$2.95** 10 Up **$2.40**

Double Way

L 1035 **$3.98** 10 Up **$3.45**



TV Splitters



Low Loss TV Splitters

Suitable for VHF/UHF TV & FM
Spring loaded cable clamps enable super quick termination.
PCB facilitates good screening.
High isolation leg to leg (40dB min.)
Silk screened circuit on PCB.
Insertion loss -
L 1310 3.5dB - L 1320 6.5dB

75 Ohm IN 2 x 75 OUT

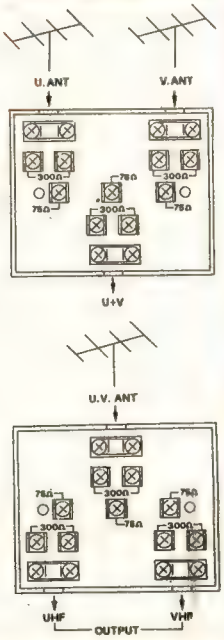
L 1310 **$4.95**

10 Up **$4.50**

75 Ohm IN 4 x 75 OUT

L 1320 **$13.50**

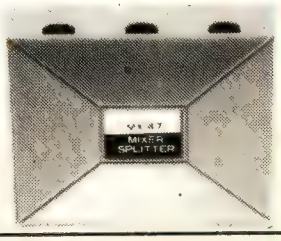
10 UP **$12.95**

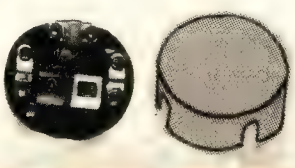


TV UHF/VHF Mixer/Splitter

Super handy mixer/coupler. Enables coupling of UHF to one lead or provides splitting function from a single antenna to separate UHF and VHF TV set input sockets.

L 1400 ONLY **$14.95**





Indoor Diplexer

Use for coupling UHF and VHF antennas into one lead to TV set.

Low Cost

L 1402 **$7.85**

Engineering Multimeter

- 38 Ranges
- Temperature
- Capacitance
- Transistor Tester
- Frequency Counter
- Diode tester
- High Impact Case
- Large LCD
- Designed to meet IEC 348 Class II and UL 1244 standards

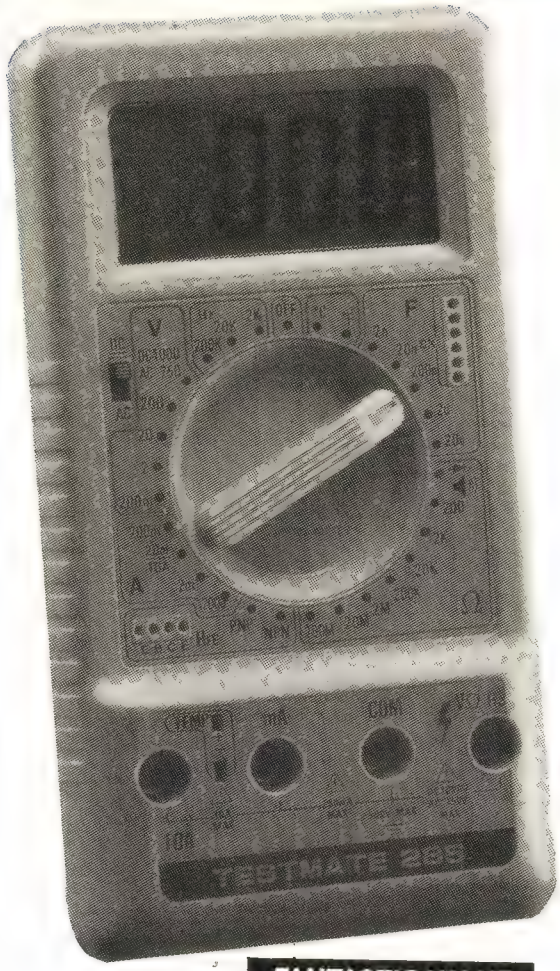
The ultimate multimeter for design engineer, bench technician and hobbyist.

Now you can have a quality multimeter that has everything you will ever need in a multimeter at an affordable price. The quality design and high sampling rate make this multimeter incredibly accurate, and the high impact case means this meter will last you a lifetime.

Q 1064 Multimeter **$149.00**

Q 1065 Carry Case for Q 1064 **$12.50**

Q 1067 Temperature probe for Q 1064 **$29.95**



FANTASTIC VALUE

DC VOLTAGE

Range	:	200mV,2V,20V,200V, 1000V
Accuracy	:	All ranges +/-0.5% rdg+1 dgt.
Resolution	:	100uV to 1V
Input Impedance	:	10M ohm
OL. Protection	:	500V DC/350V AC for 15 sec. on 200mV range. 1200V dc/800V AC on all other ranges

AC VOLTAGE

Range	:	200mV,2V,20V,200V,750V
Accuracy	:	200mV-200V.@50-500Hz +/- 1% rdg+4 dgts., 750V@50-500Hz +/- 1.5% rdg+4 dgts.
Resolution	:	100uV to 1V
Input Impedance	:	10M ohm
OL. Protection	:	500V DC/350V AC for 15sec. on the 200mV range, 1200V DC/800V AC on all other ranges

DC CURRENT

Range	:	200uA, 2mA, 20mA, 200mA, 10A
Accuracy	:	10A range +/- 2% rdg+3 dgts., other +/- 1% rdg+1 dgt.
Resolution	:	100nA
Voltage Burden	:	10A range 700mV max other ranges 325mV max
OL. Protection	:	10A input, unfused, up to 12A for 30 sec. Other ranges input 0.8A/250V fuse

AC CURRENT

Range	:	200uA, 2mA, 20mA, 200mA, 10A
Accuracy	:	10A range @ 50-500Hz +/- 2% rdg+4 dgts. other ranges @ 50-500Hz +/- 1.2% rdg+4 dgts.
Resolution	:	100nA
Voltage Burden	:	10A range 700mV max other ranges 325mV max
OL. Protection	:	10A input, unfused, up to 12A for 30 sec. other ranges input 0.8A/250V fuse

RESISTANCE

Range	:	200ohm, 2kohm, 20kohm, 200kohm, 20Mohm, 200Mohm
Accuracy	:	200Mohm, +/- 5% (rdg-10 dgts.) + 4 dgts., 20Mohm +/- 3% rdg+1 dgt., 200ohm +/- 1% rdg+3 dgts. other ranges +/- 0.8% rdg+1 dgt.
Resolution	:	100Mohm
OL. Protection	:	500V DC/AC
Test Voltage	:	200ohm ranges 3.2V max. 20Mohm range 0.3V max, 200Mohm range 3.2V max, other ranges 0.3V max

FREQUENCY

Range	:	2kHz, 20kHz, 200kHz
Input Sensitivity	:	35mV RMS
Accuracy	:	+/- 1% rdg + 1 dgt.
Effect reading	:	10-1999
OL. Protection	:	500V DC/AC

CAPACITANCE

Range	:	2000pF, 20nF, 200nF, 2uF, 20uF
Accuracy	:	all ranges +/- 3% rdg+10 dgts.
Test Frequency	:	400Hz

TEMPERATURE

Range	:	-20° C 60 1000° C 0° C to 2000° F
Accuracy	:	+/-(1% rdg+2 dgts) up to 400° C, +/-(2% rdg+2 dgts) over 400° C
Resolution	:	1° C, 1° F

INSTANT CONTINUITY

Response	:	100m SEC

DIODE TEST

Test Current	:	1.0 +/- 0.6mA
Test Voltage	:	3.2V max

TRANSISTOR hFE

Base DC Curren..	:	10uA
Vce	:	2.8+0.4V

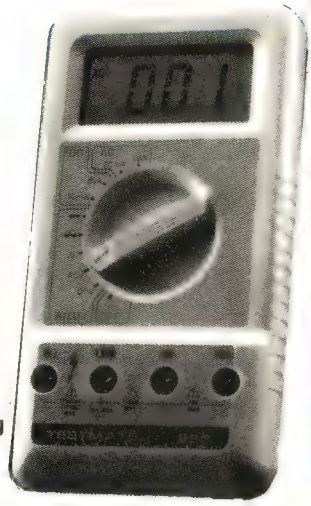
GENERAL

Display	:	3½ digit liquid crystal with maximum reading of 1999
Overrange Indication	:	Highest digit of (1) or (-1) is displayed
Low Battery	:	display
Measurement Rate	:	3 measurements per second nominal
Power	:	Single standard 9-volt battery

Auto-Ranging Multimeter

Easy to Read and Operate

- Auto-Ranging with Large Display.
- Continuity Check/Diode Test.
- Overload Beeper Indication.
- Range Annuciation.
- Battery Low indication.



SPECIFICATION

DC Voltage

Ranges	: 5 (200mV, 2V, 20V, 200V, 1000V)
Accuracy	: + (0.5% + 1 dgt.)
I/P Impedance	: 100M ohm, 200mV Range 10M ohm, the other Ranges
O/L Protection	: 1100V max DC or AC Peak

AC Voltage

Range	: 4 (2V, 20V, 200V, 750V)
Accuracy	: 1%
I/P Impedance	: 10M ohm
O/L Protection	: 1100V max DC or AC Peak

DC Current

Ranges	: 20mA, 10A
Accuracy	: 20mA (1.2%) 10A (2%)
Resolution	: 20mA = 10uA 10A = 10mA

AC Current

Range	: 20mA, 10A
Accuracy	: 20mA (1.5%) 10A (2%)

Resistance

Ranges	: (200ohm, 2Kohm, 20Kohm, 200Kohm, 2Mohm, 20Mohm)
O/L Protection	: 500V max DC or AC rms
Buzzer sounds at	: less than 700ohms

General

Display: 3½ digit LCD display maximum reading 1999
Battery Life: 500 hour approx.
Power Supply: Two "AAA" batteries 1.5V.
Sampling Rate: Twice per second
Operating/Storage Temperature & Humidity: 0° C to 50° C below 80% RH, — 10° C to 60° C below 70% RH humi
Overload Indication: LCD will show a "1" flashing in the highest position accompanied with a continuous buzz
Dimension & Weight: 150mm x 80mm x 35mm, 250 grams.

FANTASTIC VALUE

Multimeter Q 1072 $89.00

Carry Case Q 1073 $12.50

Autoranging LCD Multimeter With Memory Function and Bar Graph Display

DIRECT IMPORT VALUE

This popular 3.5 digit Multimeter is simplicity itself. Full auto ranging on voltage and resistance measurements. The large LCD digits allow quick and efficient reading of measurements.

- 42 Segment Bar Graph Display.
- Auto-ranging on Voltage and Resistance.
- Memory Mode.
- Low OHM Range.
- Hold Facility.
- Automatically indicates negative inputs.
- Low Battery Indicator.
- Continuity check with Buzzer.

SPECIFICATION

DC Voltage

Ranges	: 5 (200mV, 2V, 20V, 200V, 1000V
Accuracy	: + (0.5% + 1 dgt.)
Input Impedance	: 100M ohm, 200mV Range 10M ohm, the other Ranges
Overload Protection	: 1100V max DC or AC Peak
Resolution	: 100uV

AC Voltage

Range	: 4 (2V, 20V, 200V, 750V)
Accuracy	: + (0.75% + 5 dgts) (40Hz to 500Hz)
Input Impedance	: 10M ohm
Overload Protection	: 1100V max DC or AC Peak
Resolution	: 1mV

DC Current

Ranges	: 200mA, 10A
Accuracy	: 200mA = + (0.75% + 1 dgt) 10A = + (1.50% + 5 dgts)
Overload Protection	: 200mA = 0.2A 250V fuse 10A = 12A max. (60 sec.)
Resolution	: 100uA

AC Current

Range	: 200mA, 10A
Accuracy	: 200mA = + (1% + 5 dgts) 10A = + (2% + 5 dgts) (40 Hz to 500 Hz)
Overload Protection	: 200mA = 0.2A 250V fuse 10A = 12A max. (60 sec.)
Resolution	: 0.1mA, 0.01A

Multimeter
Q 1075 $119.00

Holster
Q 1077 $12.50

Carry Case
Q 1076 $12.50

Resistance

Ranges	: Low-power ohms (open circuit V: 450mV approx) 5 (2Kohm, 20Kohm, 200Kohm, 2Mohm, hm) Hi-power ohms (open circuit V: 900mV approx) 6(200ohm,2Kohm 20Kohm, 200Kohm, 2Mohm, 20Mohm)
Overload Protection	: 250V max DC or AC rms
Resolution	: Low — 1 ohm, High — .1 ohm
Buzzer sounds at	: 19 digits
Memory Mode at Manual Range:	Yes

NEW IMPROVED

General

Display	: 3½ digit liquid crystal 10mm

PHONEORDER TOLL FREE 008 999 007

True RMS AC Reading Analog/Digital Multimeter

A truly precision 90° displacement analog meter. Ideally suited to laboratory and the engineering test or design bench.

- True RMS AC
- dB Meter
- 10Mohm Input Impedance
- 3½" Digital Display
- 4½ Analog Meter
- DC Volt/AC Volt 100uV-1000V
- DC Amp/AC Amp 0.01uA-10A
- Resistance 0.1ohm-20Mohm
- Diode Check
- Continuity Check

GENERAL

Reading, Analog: 4½" Meter, Mirrored Read 90° Arc Scale with Knife Edge Pointer
Digital: 3½ Digit LCD, 0.5" Height, with Polarity and "LO BAT" Indication
Overrange Indication: ½ digit 1 on, other digits off.
Operating Environment: 0°C to 40°C *80% Relative Humidity*
Storage Environment: -15°C to 65°C
Power Supply: 9V Alkaline or Carbon-Zinc Battery
Battery Life: 500 hours with Alkaline Battery
Low Battery: Indicates "LO BAT" when less than 20% of Life remains

DIODE CHECK

Measurement Current: 1mA
Protection: 380V AC

CONTINUITY CHECK

Visual Check: Meter Point to Zero
Audible Check: Buzzer Sound

SIZE & WEIGHT

125x170x50mm, 520g

NEW FOR '91

PRODUCT SPECIFICATIONS

DC Voltage
Ranges: 200mV, 2V, 20V, 200V, 1000V
Resolution Digital: 100uV, 1mV, 10mV, 100mV, 1V
Accuracy Analog: +/- 3%
Accuracy Digital: +/- 0.5% + 5 dgt

AC Voltage
Ranges: 200mV, 2V, 20V, 200V, 750V
Resolution Digital: 100uV, 1mV, 10mV, 100mV, 1V
Accuracy Analog: +/- 4%
Accuracy Digital: +/- 0.75% + 5 dgt
+/- 1.5% + 5 dgt (750V range)

DC Current
Ranges: 20uA, 200uA, 2mA, 20mA, 10A
Resolution Digital: 10nA, 100nA, 1uA, 10uA, 50mA
Accuracy Analog: +/- 3%
Accuracy Digital: +/- 0.5% + 5 dgt

RMS AC Current
Ranges: 20uA, 200uA, 2mA, 20mA, 200mA, 2A, 10A
Resolution Digital: 10nA, 100nA, 1uA, 10uA, 100uA, 1mA, 10mA
Accuracy Analog: +/- 4%
Accuracy Digital: +/- 0.75% + 5 dgt
+/- 1.5% + 5 dgt (2A)
+/- 2% + 5 dgt (10A)

dB Meter AC RMS
Ranges: -20db, 0dB, +20db, +40db
Coverage: -45 to -10, -25 to +10, -5 to +30, +15 to +50dB
Resolution: 0.1dB

Resistance
Ranges: 200, 2K, 20K, 200K, 2M, 20M
Resolution Digital: 100m, 1, 10, 100, 1K, 10K
Accuracy Analog: +/- 4%
Accuracy Digital: +/- 0.75% + 3 dgt

Q 1090 $199.50

Digital Multimeter + LCR Meter

This truly fantastic bench Digital Multimeter + LCR, with capacitance and inductance ranges, enable you to test a wide variety of components. Indispensible for the design engineer, technician and enthusiast alike.

Product Specifications
Note: Accuracy specifications are +/- (% of reading +/- number of digits)

DC Voltage
Range: 200mV, 2V, 20V, 200V, 1000V
Accuracy: 0.5% + 1
Input Impedance: 10M Ohm on all ranges
Overload protection: 1000V DC.Peak AC on all ranges

AC Voltage
Range: 200mV, 2V, 20V, 200V, 750V
Accuracy: (50-500Hz): 0.8% + 4, 1.2% + 4 (750V)
Input Impedance: 10M Ohm on all ranges
Overload protection: 750V rms on all ranges

DC Current
Range: 200uA, 2mA, 20mA, 200mA, 2A
Accuracy: 1% + 1 (200•A - 20mA)
1.5% + 1 (200mA - 20A)
Burden Voltage: 0.3V max (to 20mA), 1.2V max (to 20A)
Overload protection: 2A fuse up to 250V, 20A range not fused

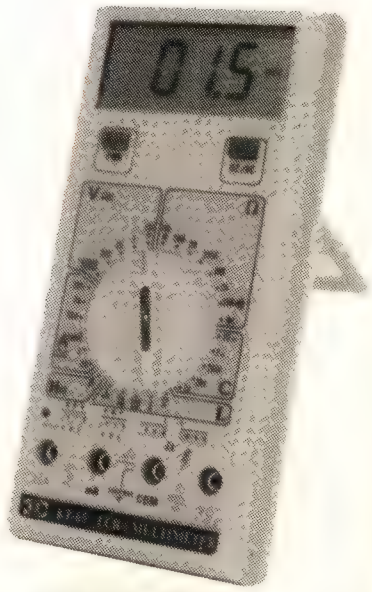
AC Current
Range: 200uA, 2mA, 20mA, 200mA 2A, 20A
Accuracy: 1.2% + 4 (200uA - 20mA)
2% + 4 (200mA - 20A)
Burden Voltage: 0.3V max (200•A - 20mA), 1.2V max (200mA - 20A)
Overload Protection: 2A fuse up to 250V, 20A range not fused.

Resistance
Range: 200Ohm, 2kOhm, 20kOhm, 200kOhm, 2MOhm, 20MOhm, 200MOhm
Overload protection: 250V DC/rms on all ranges

Capacitance
Range: 2nF, 20nF, 200nF, 2uF, 20uF
Test Signal: 1kHz, 1.5Vp-p
Max Input: 5V DC/Peak AC on all ranges

Inductance
Range: 2mH, 20mH, 200mH, 2H, 20H
Test Signal: 1 kHz 1.5Vp-p
Max Input: 5V DC/Peak AC on all ranges

hFE test: 0 - 1000 hFE values either NPN or PNP transistor, (text condition: 1b = 10uA, Vce = 2.8V).
Diode test: on all model, diode forward voltage, forward current about 1mA, reversed DC voltage about 2.8V.

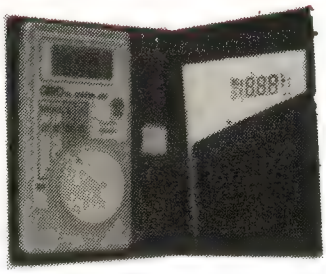


FANTASTIC VALUE

Price Breakthrough **Q 1062 $149.00** Carry Case Q1068 $12.50

PHONEORDER TOLL FREE 008 999 007

Credit Card Multimeter



Fantastic for the glovebox, toolkit and, of course, your top pocket. Excellent for mobile field work. A great gift idea for your budding genius student.

Specifications

DCV: 200mV, 2V, 20V, 200V, 750V
ACV: 2V, 20V, 200V, 500V
OHM: 200Ohm, 2kOhm, 20kOhm, 200kOhm, 2MOhm, 20MOhm
Includes continuity tester

Q 1060 **$65.00** *Value*

17 Range Digital Multimeter

with Overload Protection

Australia's best value, less than $50

DIRECT IMPORT PRICE

Specification:

DC Voltage
Range: 2V, 20V, 200V, 2000V
O/L Protection: 500VDC/350VAC for 15 sec. on 200mV range. 1200VDC/800 Vac on other ranges.

AC Voltage
Range: 200V, 500V
O/L Protection: 500VDC/750VAC for 15 sec.

DC Current
Range: 200mA, 20mA, 2mA, 10A
O/L Protection: 10A range input, unfused, up to 12A for 30 sec. other range input, 0.8A/250V fused.

Resistance
Range: 200Ohm, 2kOhm, 20kOhm, 200kOhm, 2MOhm
O/L Protection: 500VDC/AC

Diode Test
Test Current: 1.0 +/-6mA
Test Voltage: 3.2V Max.

Battery Test
Range: 1.5V, 9V
Loaded Current: 1.5V 100mA, 9V 6mA
Weight: 0.19kg including battery
Dimensions: 130x71x35mm

Q 1056 **$49.95**

Carry Case Q 1057 **$12.50**

Portable Multimeter

with Bench Stand

Includes Continuity Buzzer
20,000 Ohms/volt DC 8,000 Ohms/Volts AC, Mirror backed scale Overload protected, 10 amp DC current range. Unique carry handle doubles as a bench stand.

Ranges:

DC Voltage	2.5, 10, 50, 250, 1000V
AC Voltage	10, 50, 250, 1000V
Decibels	-8dB to -62dB
DC Current	5,50,500mA + 10 Amps
Ohm Meter	R x 1, R x 10, R x 1k, 3 ranges 50 Ohms centre scale
Size	135 x 91 x 39mm

Includes Battery Tester

Q 1018 **$39.95**

Carry Case Q 1019 **$4.95**

Economy Pocket Tester

Q 1013

200 Ohms/Volt sensitivity
Overload protected
Dimensions 90 X 60 x 60mm
Mirror back scale helps prevent parallax error
Complete with test leads and instructions
Uses 1 x AA Battery (supplied)
Ranges: DC and AC 0-110 50, 250, 1000V
Decibels: 10 to +22dB
Current: 0-100mA
Ohms: 0.1 Meg. in two ranges

$19.50 Carry Case Q 1014 **$4.50**

Electronic FET Laboratory Multimeter

Centre Zero Pointer Setting Allows + and - Readings

The Q 1050 breaks new ground for an advanced, precision analogue meter of this quality below $100. The Q 1050 has the advantage of digital multimeters i.e. significant circuit loading, high accuracy etc. without the misleading and erroneous readings that DVM's are famous for.

Q 1050 **$99.95**

- 10 Meg Ohm input
- 12 amp DC & AC Current Ranges
- Centre Zero Pointer Adjust for + and - Readings
- Single Range & Polarity Reversing Switch
- Power On LED Indicator
- P-P Calibrated Scale

Q 1052 Carry Case **$12.50**

DC Volts
Ranges: 0 - 0.3, 1.2, 12, 30, 120, 300, 1200V. - 0 +/- 1.5, 0.6, 6, 15, 60, 150, 600+V at Centre 0.
Input Impedance: Approx 10M Ohm, 3M Ohm on 300mV range
Rated Accuracy: +/-2.5% DC and +/-3.5% AC full scale on all ranges

AC Volts
Ranges: RMS 0 - 3, 12, 30, 120, 300, 1200V. Peak-peak 0 - 8.4, 33, 84, 330, 840, 3300.
Input Impedance: Approx 1M Ohm 80PF, 2.5M Ohm on 3V Ranges

DC Current
Ranges: 0 - 0.1 uA 0.3, 3, 30, 300mA, 12A.
Potential Drop: 300mV
Rated Accuracy: Within +/- 2.5% full scale, all ranges.

AC Current
Ranges: 0 - 12A

DC Resistance
Ranges:
R x 1 0 - 1k Ohm (Centre 10Ohm)
R x 10 0 - 10k Ohm (Centre 100Ohm)
R x 100 0 - 100k Ohm (Centre 1kOhm)
R x 10K0 - 10M Ohm (Centre 10kOhm)
R x 1M 0 - 1000M Ohm (Centre 10MOhm)

PHONEORDER TOLL FREE 008 999 007

Sensational Labtech *Full 12 Months Warranty*

Australia's Best Value In High Reliability, Top Performance Cathode Ray Oscilloscopes.

20MHz Dual Trace Oscilloscope

Description:
This model is a dual trace 20MHz Oscilloscope using a high brightness CRT. The vertical amplifiers have high sensitivity of 5mV/div and a frequency characteristic response with smooth roll off exceeding 20MHz.

The TV sync. signal separator circuit is provided to ensure stable observation of video signals. Triggering is obtained by sampling the AC power waveform, external waveform or internally generated trigger. Power consumption is only 19 watts and weight is only 7kgs.

Q 0156 $699

Highly recommended for Service Workbench, Design Laboratory, Manufacturers, Universities and the dedicated Enthusiast.

NEW LOW PRICE

Features:
Wide bandwidth and high sensitivity. Very low power consumption. High sensitivity X-Y mode. Z axis (intensity modulation). Front panel electrical trace rotator. Regulated power supply circuit for accuracy..
TV video sync. filter. High frequency rejection filter in the triggering circuit.

1. CRT Display
150mm rectangular, domed mesh and post accelerator type with an illuminated, parallax-free, inner-face graticule.
8 x 10 division (1 division = 10mm)

2. Vertical Deflection

Deflection Factor:	5mV to 20V/Div on 12 ranges in 1-2-5 step with fine control.
Bandwidth DC:	DC to 20MHz (-3dB) AC: 10Hz to 20MHz (-3dB)
Rise Time:	Less than 17.5nSec
Overshoot:	Less than 8%
Input Impedance:	1M Ohm shunted by 20pF +/- 3pF (Max input: 600Vp-p or 300V DC + AC Peak)
Operating Modes:	CH-A, CH-B, DUAL and ADD
Chop Frequency:	200kHz approx.
Channel Separation:	Better than 60dB at 1KHz
CH-B Polarity:	CH-B can be inverted.

3. Time Base

Type:	Automatic and triggered. In automatic mode, sweep is obtained without input signal.
Sweep Time:	0.2uSec to 0.5Sec/Div on 20 ranges in 1-2-5 step with fine control and X-Y.
Magnifier:	X5 at all ranges
Linearity:	Less than 3%

4. Triggering

Sensitivity:	Int 2 div or more Ext: 1Vp-p or more
Source:	INT, CH-B, LINE or EXT
Triggering Level:	Positive and Negative, continuously variable level control. Pull for Auto.
Range:	20Hz to 20MHz or more
Sync:	AC, HF Rej, TV (each + or -) at TV Sync. TV-H (Line) and TV-V(Frame) sync are switched automatically by SWEEP TIME/Div switch. TV-V: 0.5 sec/div to 0.1m sec/div TV-H: 50 usec/div to 0.2 usec/div

5. Horizontal Deflection

Deflection Factor:	5mV to 20V/div on 12 ranges in 1-2-5 step with fine control.
Frequency Response:	DC to 1MHz (-3dB)
Input Impedance:	1M Ohm shunted by 20pF + 3pF
Max Input Voltage:	300V DC.+ AC peak or 600Vp-p
X-Y Operation:	X-Y mode is selected by SWEEP TIME/Div switch CH-A: Y axis CH-B: X axis
Intensity Modulation Z Axis:	TTL Level (3Vp-p~50V) + bright, -dark.

6. Other specifications

CRT HV:	2kV
Calibration Voltage:	0.5Vp-p +/- 5%, 1kHz square wave
Power Requirements	AC: 100V/120V/220V/240V, 50/60Hz, 19W
Weight:	7Kg approx
Dimensions:	162(H) x 294(W) x 352(D)mm

Probe Sets

Specification
Position x 10

Bandwidth:	D.C. to 80MHz
Max Input Voltage:	600 Volts D.C.

Position x 1

Bandwidth:	D.C. to 3MHz
Max Input Voltage:	600 Vots D.C.
Probe Length:	Approximately 1.5 meters

Q 0175 $49.95

PHONEORDER TOLL FREE 008 999 007

40MHz Dual Trace Oscilloscope

A superb oscilloscope for technicians and engineers working on projects where other instruments would be stretched beyond their capabilities.

Where precise measurements of computers, CD's, digital videos, RF applications, high speed digital, and other high speed equipment is a must.

With Features Like:

• Delayed sweep for partial waveform expansion. • Channel 1 signal output for use with a frequency counter • CH2 polarity inversion switch • Vertical deflection magnification, X5 • Switchable chopping frequency • Scale illuminating system • B Intensity control for bright, magnified waveforms • Variable hold-off for observation of waveforms with complex periods • Single sweep mode for one time or other suddenly occuring events • Sweep magnification, X10 • Signal delay line for accurate view of high frequency pulse leading edge • Trigger preset function.

Q 0160 $1495

1. CRT Display

150mm rectangular, domed mesh and 12kV post accelerator type with an illuminated, parallax-free, inner-face graticule.
8 x 10 division (1 division = 10mm)

2. Vertical Amplifier (CH1 and CH2 Identical)

Operational Modes:	CH1, CH2, ADD, DUAL, ALT, CHOP
Sensitivity:	5mV - 5V/Div 3% in 1-2-5 steps 1mV - 1V/Div 5% X5 Mag
Bandwidth DC:	DC to 40MHz (-3dB) AC: 5Hz to 40MHz (-3dB)
Rise Time:	Less than 8.7nS
Polarity Inversion:	CH2 only
Chop Frequency:	Approx 250KHz
Maximum Input Voltage:	400V (DC + AC peak)
Input Coupling:	AC, GND, DC

3. Horizontal Amplifier

Operating Modes:	X-Y operation CH1-X axis, CH-2 Y axis
Sensitivity:	5mV - 5V/Div +/- 3% in 1-2-5 steps
Input Impedance:	1MOhm +/- 2%, 25pF +/- 3%
Bandwidth DC:	DC to 1MHz (-3dB) AC: 5Hz to 1MHz (-3dB)
X-Y Phase Shift:	3° or less (at 100KHz)
Maximum Input Voltage:	400V (DC + AC peak)

4. Time Base

Sweep Method:	AUTO, NORM, SINGLE
Sweep Time (A):	0.2uS - 0.5S/Div +/- 3% in 1-2-5 steps (X1 only)
Sweep Time (B):	0.2uS - 0.5mS/Div +/- 3% in 1-2-5 steps (X1 only)
Magnified Sweep:	10 times +/- 5%, Max 20nS
Linearity:	+/- 3% or better
Delay Method:	Continuous delay and adjustment
Delay Time:	2nS - 5S
Hold Off:	Continuously adjustable of A sweep

5. Synchronization

Horizontal Mode:	A, B, B Triggered
Internal:	V-MODE, CH1, CH2, LINE
External:	EXT
Trigger Coupling:	AC, DC, HF Rej, TV-H (Line), TV-V (Frame)
Triggering Sensitivity:	INT. DC - 20MHz 1.0 Div 20MHz - 40MHz 2.0 Div EXT. DC - 20MHz 150mVp-p 20MHz - 40MHz 300mVp-p

Trigger Level Preset Function

6. Vertical Amplifier Signal Output

Output Voltage:	Approx 50mV/Div
Output Impedance:	50 Ohm
Bandwidth:	100Hz - 40MHz (-3dB)

7. Intensity Modulation Z Axis

Bandwidth:	DC - 1MHz
Maximum Input Voltage:	50V (DC + AC peak), Max AC 1KHz
Sensitivity:	3Vp-p

8. Probe Calibrator Output Voltage

Squarewave Approx. 1KHz, 1V

9. Power Requirements

Voltage: AC 100V/117V/230V/240V +/- 10%, 50, 60Hz, 42W

10. Dimensions, Net Weight

340W X 138H X 373Dmm, 9kg

11. Accessories

Operations manual, power cord, fuse.

Laboratory Series Audio Oscillator

Specifications

Frequency Range:
200Hz range: 20Hz—200Hz,
2kHz range: 200Hz—2kHz,
20kHz range: 2kHz—20kHz,
200kHz range: 20kHz—200kHz

Sine Wave Characteristics:
Output voltage: 5V RMS or more at no load
Distortion factor (at max output)
200Hz range: 0.5% or less
2kHz range: 0.15% or less
20kHz range: 0.15% or less
200kHz range: 0.5% or less
Output impedance: 600 Ohms +/-10%

Output attenuator: 0 to greater than 50dB continuously variable, 10dB, 20dB and 40dB steps within +/- 3% for each step.

External Synchronisation Characteristics
Input impedance: approx. 10kOhms
Max. allowable input voltage: 10V RMS
0.01%, +/-1 count

Reading Accuracy
0.01%, +/-1 count

Frequency Counter Characteristics
Display: 4 digits, 7mm red LED display
Frequency range: 10Hz—1Mhz (square wave)
Sensitivity: 25mV RMS
Max. input: 150V p-p
Input impedance: 1MOhm

Square Wave Characteristics (TTL Out)
Overshoot: 2% or less (at 1kHz)
Duty ratio: 50% +/-5% (at 1kHz) level; fixed amplitude, logic 0 less than 0.4V; logic 1 more than 2.4V, Rise/fall time: 200n sec or less

General
Power requirements: 100/120/220V +/-10%
240V +5%, -10%, 48-66Hz
Operating environment: 0°C to 500°C (accurately specified at 25°C+/-5°C)
Dimensions: 205W X 26H X 267D mm
Weight: 2270g

Q 1547 $480

More than compares with competitors' products for $100 and more.

Audio Frequency Generator

In testing audio circuitry it is necessary to have an accurate audio signal source. It even allows you to test 455KHz IF stages!

Specifications

Frequency Range:	10Hz - 1MHz
Accuracy:	+/- 3% + 2Hz
Output Waveforms:	Sine/Square
Output Level:	**Sine:** 8V rms **Square:** 10V P-P
Output Attenuator	-20dB, -40dB and fine adjust

Q 1540 $299.00

Tuck this fantastic sine/square wave oscillator away in your tool box

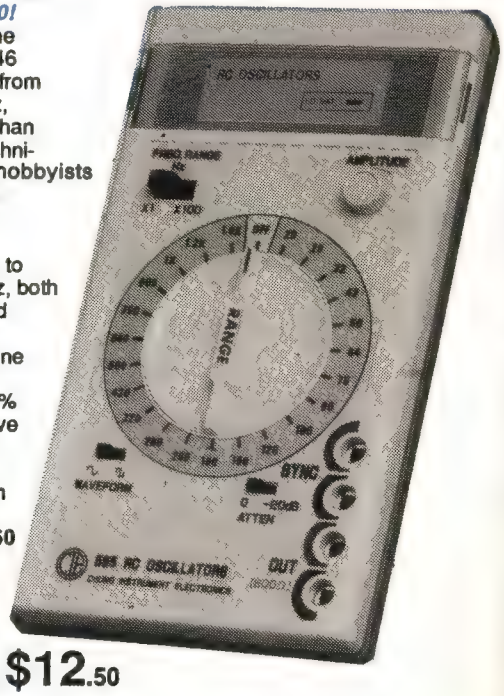
Pocket sized, personal Audio Signal Generator

Now you can have a full function audio signal generator for less than $100!

This pocket sized oscillator has all the features of a large bench oscillator. 46 preset switched frequencies ranged from 20Hz to 150kHz. e.g. 1kHz, 1.2kHz, 1.5kHz, 1.8kHz, 2kHz etc. Smaller than most multimeters, this is ideal for technicians, servicemen, students and hobbyists who require an accurate and reliable oscillator ready to use anywhere.

Specifications:

Frequency Range: X 1 range 20Hz to 1.5kHz **X 100 range** 2kHz to 150kHz, both ranges are selectable via 23 selected ranges
Output Control: 0dB, -20dB plus fine adjuster
Output Impedance: 600Ohm +/- 10%
Waveform: sine wave or square wave (switchable)
Sine Wave: 1.2V rms maximum
Square Wave: 8V P-P maximum
Rise & Fall Time: Less than 5 uS
Internal 9V battery provides over 50 hours continuous use.



Q 1542 Oscillator $99.50

Q 1544 Protective Carry Case $12.50

PHONEORDER TOLL FREE 008 999 007

1GHz Frequency Counter

This new addition to the Labtech range will astound you with its high accuracy and stability. A truely professional instrument that will perform brilliantly in the workshop, laboratory, university etc.

Specifications

1. Measuring Mode

Frequency Measurements

Channel A

- Range: 10 to 10MHz direct counter 10MHz to 100MHz prescaled by 10
- Resolution: Direct counter: 1, 10, 100Hz switch selectable Prescaled: 10,100, 1000Hz switch selectable
- Gate time: 0.01S, 0.1S, 1S switch selectable
- Accuracy: +/- 1 count +/- time base error x frequency

Period Measurements (channel A)

- Range: 10Hz to 2.5MHz
- Resolution: 10^{-7}S, 10^{-8}S,10^{-9}S switch selectable
- Accuracy: +/- 1 count +/- time base error x period

Totalize measurements (channel A)

- Range: 10Hz to 10MHz
- Resolution: +/- 1 count of input

2. Input Characteristics

Channel A

- Input sensitivity: 25mV RMS sine wave or 70mV p-p
- Attenuation x 1, x 20 fixed
- Impedance: approx 1M Ohm, less than 35pF
- Maximum voltage without damage: 250V (DC + AC rms)

Channel B

- Input sensitivity: 15mV RMS sine wave or 50mV p-p
- Impedance: approx 50 ohm
- Maximum voltage without damage: 3V

Time Base

- Frequency: 10MHz, 3.90625MHz
- Ageing rate: +/- 3 x 10^{-7}/month
- Temperature: +/- 1 x 10^{-6}, 0°C to 40°C
- Line Voltage: +/- 1 x 10^{-7} for 10% change
- Warm-up time: 20 minutes when cold started at 25°C

General

- Display: 8 digits, 7mm red LED display with decimal point, gate, overflow, KHz, MHz and uS indication.
- Check: Counts internal 10MHz time base oscillator.
- Power requirement: Line: 115/230V +/- 15%, 45Hz - 70Hz
- Temperature: Rated range of use: -5°C - +50°C
- Storage and transport: -40°C - +60°C
- Humidity: Operating: 10 - 90% RH. Storage: 5 - 95% RH

Q 1530

$499.00

150MHz Frequency Counter

A frequency counter is invaluable for the accurate allignment and testing of many modern electronic circuits.

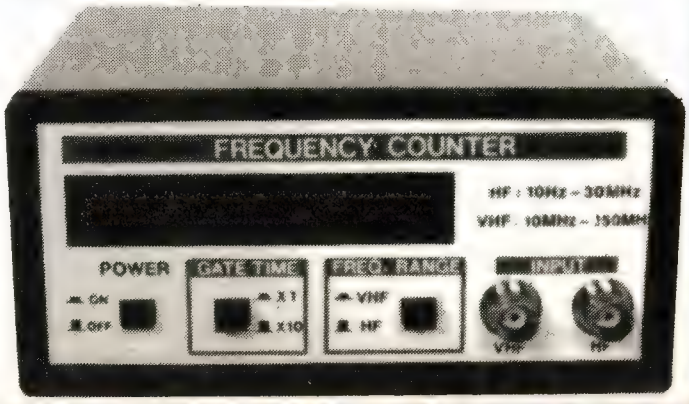
Specifications:

Frequency Range	10Hz - 150Mhz
Gate Time	1 sec, 6 sec
Accuracy	+/- 1 count
Max. Input	20V P-P
Sensitivity:	
● 10Hz - 30MHz	25mV - 100mV
● 10MHz - 150MHz	100mV - 300mV
● Power requirement	9V DC @ 100mA

Q 1520

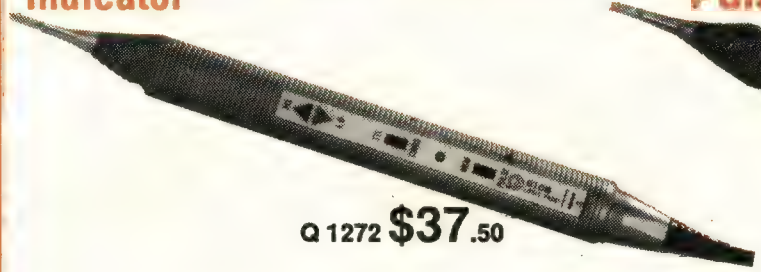
$199.00

Use our 9V Plug Pack M 9004



PHONEORDER TOLL FREE 008 999 007

20MHz Logic Probe with Audio Indicator



Q 1272 **$37.50**

50MHz Logic Probe with Logic Pulser

Q 1280 **$54.95**

	Q 1272	Q 1280
Maximum input signal frequency	20MHz	50MHz
Input impedance	1MOhm	120kOhm
Opperating supply range	4V DC minimum,	18V DC maximum
TTL: Logic "1" (HI LED)	> 2.3+/-0.2V DC	> 3.0+/-0.25V
Logic "0" (LO LED)	< 0.8+/-0.2V DC	< 0.75+/-0.25V
CMOS: Logic "1" (HI LED)	> 70% Vcc+/-10%	> 60% Vcc+/-5%
Logib "0" (LO LED)	< 30% Vcc+/-10%	< 15% Vcc+/-5%
Mimimum detectable pulse width	30 Nanoseconds	10 Nanoseconds
Maximum signal input protection	+/-220V AC/DC (for 15seconds)	+/-70V AC/DC (for15seconds)
Power supply protection	+/- 20V DC	+/-20V DC
Pulse indicator flash time	500ms	

LOGIC PULSER (Model Q 1280)

Synch input impedance	1MOhm
Pulse rate	0.5/400Hz
Pulse width	10uS
Output current	100mA sink/source
Square wave output current	5mA sink/source
Power suply range	5 - 15V DC
Power supply protection	20V DC (30seconds max)
Synch input protection	120V DC (30 seconds max.)
Test point protection	35V DC (30 seconds max.)

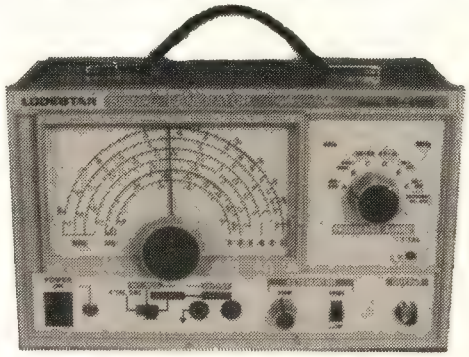
RF Signal Generator

An absolute necessity for radio servicing. With provision for both internal & external modulation.

Specifications:

Frequency Range	100kHz - 150MHz in 6 ranges
RF Output Level	100mV rms
Accuracy	+/- 3%
Modulation:	
● Internal (30% depth)	1kHz
● External	50Hz - 20kHz
● Crystal Locked Oscillator	

Q 1550 **$299.00**



Test Equipment Accessories

Test Leads

P 0411 Banana Plugs to IC Clips **$4.95**

P 0412 Pin Plugs to IC Clips **$3.75**

Meter Test Leads

P 0402 Pin Plugs to prods **$3.70**

P 0403 Banana Plugs to prods **$3.90**

P 0405 Banana Plugs to Croc Clips **$2.95**

Bench Test Leads

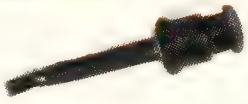
Croc Clip to
Croc Clip H/Duty

P 0415 $8.35

Multimeter Plug/Test Prods

		Ea	10 Up
P 0165	Tip Plug Red	.70	.65
P 0166	Tip Plug Black	.70	.65
P 0167	Tip Probe Red	.95	.85
P 0168	Tip Probe Black	.95	.85

Probe type IC Test clips which slip on to the end of meter leads.



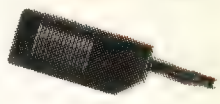
		Ea	10 Up
P 0182	Red Probe	$1.20	$1.00
P 0183	Black Probe	$1.20	$1.00

Multimeter Plugs

Cross Hole

		Ea	10Up
P 0274	Red	$1.40	1.30
P 0276	Black	$1.40	1.30

Stack Type

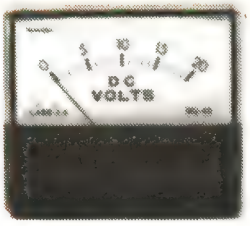


		Ea	10Up
P 0282	Red	$1.60	1.50
P 0284	Black	$1.60	1.50

MU 45

Quality Class 2.5

Overall dimensions 58W x 52H. Bolt mounting centres 38mm x 38mm. Hole required 44mm. Nuts and washers provided.

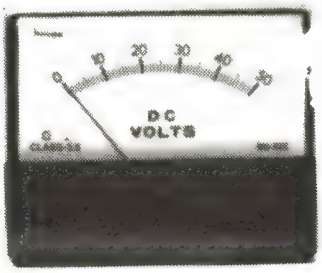


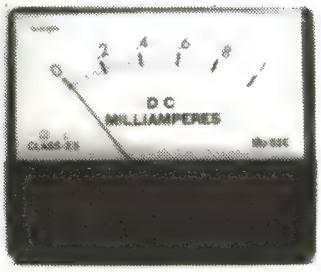
Cat. No.	FSD	RES	Price	10 Up
Q 0500	1mA	200	$16.95	$15.45
Q 0505	50uA	3500	$16.95	$15.45
Q 0506	100uA	3750	$16.95	$15.45
Q 0508	1A	3	$16.95	$15.45
Q 0510	5A	.02	$16.95	$15.45
Q 0515	10A	3	$16.95	$15.45
Q 0520	20V	2000	$16.95	$15.45
Q 0525	30V	3000	$16.95	$15.45

MU52E

Quality Class 2.5

Overall dimensions 80W x 66H. Bolt mounting centres 64W x 48H. Hole required 50mm. Nuts and washers provided.

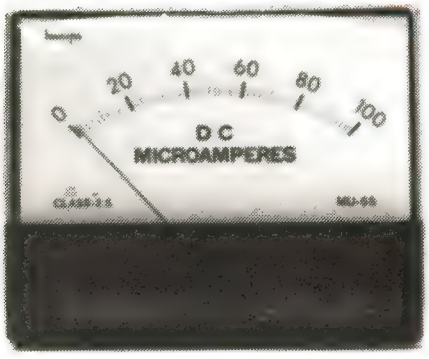




Cat. No.	FSD	RES	Price	10 Up
Q 0530	1mA	200	$21.95	$19.95
Q 0531	1A	3	$21.95	$19.95
Q 0533	5A	.02	$21.95	$19.95
Q 0535	30V	200	$21.95	$19.95
Q 0538	50V	200	$21.95	$19.95

MU 65

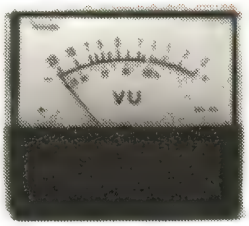
Quality Class 2.5



Overall dimensions 100W x 82H. Bolt mounting centres 80W x 64H. Hole required 63mm. Nuts and washers provided.

Cat.No.	FSD	RES	Price	10 Up
Q 0540	1mA	200	$24.50	$22.00
Q 0550	100uA	3500	$24.50	$22.00

VU Meter MU 45



Q 0528 **$16.95**

10 Up **$15.95**

Tuning Meter Centre Zero

Sensitivity (half scale) 250uA

Q 0600 **$5.95**

10 Up **$4.95**

Signal Strength Meter

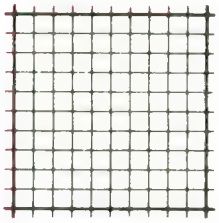
250uA FSD Scale Labelled 1-10

Q 0605 **$9.45**

10 Up **$8.45**

Bishop Graphics

Artwork Films Polyester



H 9959 8.5" x 11"

Pack of 2 **$4.75**

H 9960 11" x 17"

Pack of 2 **$7.50**

Actual Size

Pre-Spaced Pads

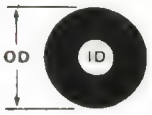
0.100" Pitch 2.54mm Scale x 1
H 9906 240 **$5.60**

0.100" Pitch 2.54mm Scale x 2
H 9907 140 **$5.60**

0.156" Pitch 3.96mm x 1
H 9908 150 **$6.45**

Donut Pads

Cat.	Size		
H 9941	0.080" OD x 0.031"	ID 96	$6.45
H 9942	0.100" OD x 0.031"	ID 96	$4.80
H 9944	0.125" OD x 0.031"	ID 96	$4.80
H 9945	0.156" OD x 0.031"	ID 96	$4.80
H 9947	0.200" OD x 0.031"	ID 108	$4.80
H 9948	0.250" OD x 0.062"	ID 128	$4.80



Transistor Patterns

H 9922 TO-5 (36 pads) $5.60
H 9924 TO-18 (36 pads) $5.60

Edge Connector Patterns

0.1" pitch (25 strips)
H 9950 **$5.30**

0.156" pitch (5 strips)
H 9952 **$5.30**

DIL Patterns

	Type	Symbols	
H 9909	14 Pin	32	$6.95
H 9910	16 Pin	32	$5.60
H 9911	18 Pin	28	$5.60
H 9912	24 Pin	12	$5.60
H 9913	28 Pin	12	$5.60
H 9914	40 Pin	8	$5.60

Narrow Cut

H 9918	14 Pin	32	$5.60
H 9919	16 Pin	32	$5.60
H 9920	40 Pin	8	$5.60

Artwork Accessories

X-Acto Knife

H 9955 **$5.95**

X-Acto Blades

H 9956 Trim pack of 5 **$3.95**

X-Acto Blades

H-9957 Art pack of 5 **$3.95**

Why Bishop Graphics Artwork is Superior

1. The artwork is very accurate. For example the D.I.L. patterns are made to a tolerance of 0.002".

2. The line tape is precision slit from large rolls under very low stress. Precise edges.

3. The line tape is very flat black. It will not reflect light and so the line will not blur due to reflected light. Result? Absolutely sharp edges to trackwork.

4. The benefits of Crepe. This tape is 'creped'. This allows tape to be curved, a saving on corner art. Once down the curve will stay where it is. Inferior tapes try to 'creep' back to straighness. Another advantage of crepe is that you can cut through a line by mistake, realise your error and burnish the tape down again. The Bishop tape will close again. Inferior tapes can leave a hairline crack of light and an open circuit track on your PCB! Finally, to state the obvious - the tape is extremely flexible!

5. The tape is only 0.005" thick. This means that the tape will not cast a 'shadow' because of its thickness.

6. The secret adhesive. You can lay Bishop art down, peel it up again and relocate it many times. PCB artwork necessitates this and this is a valuable feature. It stays sticky!

7. Another secret. The adhesive does not 'bleed'. By this we mean that the adhesive will say where it should be - under the art. Inferior adhesives creep away in time and the edges lose definition as a result. You can come back to Bishop Graphics artwork after a year and find no adhesive anywhere except under the art.

8. Its the most cost-effective. Your labour is money. When you spend a lot of valuable time on inferior artwork tape you - or your client - is losing money! More than the small difference between cheap artwork tape and value-for-money Bishop Graphics!

Targets E-Z Circuit Targets

These are designed to simplify and improve photo reduction and registration (the accurate placement of symbols and circuitry) during all stages of printed circuit artwork and board production.

H 9928 32 Symbols

$5.60

(Illustration shown actual size)

Bishop Graphics
The Leader In
PCB Artwork

Black Artwork Tape

Size		
H 9930	0.026" wide x 18M	$5.95
H 9931	0.031" wide x 18M	$4.95
H 9932	0.040" wide x 18M	$4.95
H 9933	0.050" wide x 18M	$4.95
H 9934	0.062" wide x 18M	$4.95
H 9935	0.080" wide x 18M	$4.95
H 9936	0.096" wide x 18M	$4.95
H 9937	0.100" wide x 18M	$4.95
H 9938	0.125" wide x 18M	$4.95
H 9939	0.200" wide x 18M	$6.95
H 9940	0.250" wide x 18M	$6.95

Pressure Sensitive Copper Tapes

Ideal for repairing damaged or broken conductor tracks on a PCB. Used to modify circuitry on existing PCB's.

H 9901	0.031" wide	$4.30
H 9902	0.05" wide	$4.30
H 9903	0.1" wide	$5.35

Packaged In 6 Foot Rolls

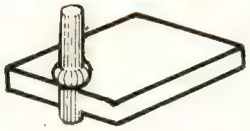
PCB ITEMS AND BREADBOARDS

Dalo Pen

Etch Resistant Ink

T 0033 **$4.20**

Matrix Pins



H 0805	Pk 50	$3.95
H 0806	Pk 1000	$34.60

Vero Type Strip Board

Alpha numeric grid. Pre-drilled. .9mm holes 2.5mm spacing, 95mm wide.

H 0711	95 x 304	$5.95
H 0712	95 x 152	$3.50
H 0714	95 x 76	$1.95

Ferric Chloride Beads

Makes 1 Litre of Solution

H 0800 $2.95

Blank Fibreglass PC Board

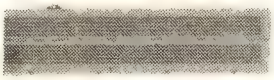
Single-sided, copper clad. 250 x 250mm

H 0755 $19.50

Breadboards

• Standard 0.1 inch spacings • Accepts all LSI's semis, transistors, diodes, leds and passives • Uses 22-30 gauge solid hook up wire for interconnections • Boards are 'keyed' to enable easy expansion.

100 Holes **P 1000 $3.25**



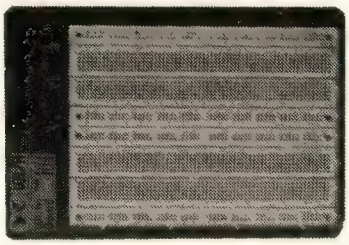
640 Holes **P 1005 $12.50**

640 + 100 Holes

P 1007 $14.50

640 + 200 Holes

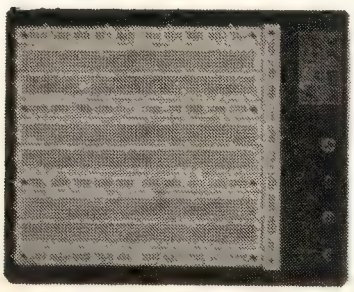
P 1009 $16.95



400 + 1280 Holes

Accepts up to 16 x 16 pin DIL IC's. Terminals for PS connections.

P 1012 $44.60



500 + 1920 Holes

Accepts up to 24 x 16 pin DIL IC's. Metal backing plate for shielding of sensitive circuitry.

P 1015 $65.00

TRADE & HANDYMAN PACKS

Self Adhesive Cable Tie Mounts

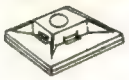
Constructed of nylon and backed with high quality self-adhesive tape. Screw mounting holes provided for heavy duty support.

21mm x 21mm

H 4110	Pk 25	$6.45
H 4112	Pk 100	$22.45
H 4114	Pk 1000	$186.60

28mm x 28mm

H 4120	Pk 25	$10.55
H 4122	Pk 100	$37.40
H 4124	Pk 1000	$315.75



Cable Ties

All of Nylon 66 (UL 94V-2) Material. Natural colour.

100mm (L) x 2.5mm (W)

H 4010	Pk 25	$1.29
H 4012	Pk 100	$3.25
H 4014	Pk 1000	$23.35

200mm (L) x 4.6mm (W)

H 4020	Pk 25	$3.55
H 4022	Pk 100	$12.00
H 4024	Pk 1000	$97.60

Nylon Cable Clamps

Cat No.	Size	Pack	
H 4210	6.7mm	6	$1.40
H 4212	6.7mm	100	$10.25
H 4214	6.7mm	1000	$86.20
H 4220	9.5mm	6	$1.55
H 4222	9.5mm	100	$11.95

Snap-In Bushings

Black Nylon bushings to insulate raw edged chassis holes. Takes up to 12.2mm cables. Fits up to 3.2mm chassis thickness. Chassis hole 16mm.

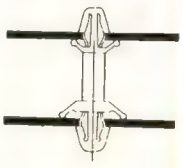
H 4350	Pk 10	$2.40
H 4352	Pk 100	$17.95

PCB Supports

4mm PCB hole required.
4.8mm chassis hole required.
Gives PCB 9.6mm clearance above chassis.
Nylon 66 (UL 94V-2)

H 1420	Pk 10	$2.45
H 1422	Pk 100	$17.35
H 1424	Pk 1000	$130.00

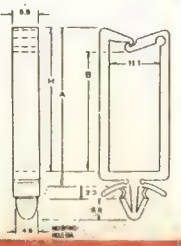
4mm PCB hole and 4.8mm chassis hole required. Nylon 66 (UL 94V-2)



H 1430	6.4mm	Pk 10	$1.75
H 1433	6.4mm	Pk 100	$17.40
H 1436	6.4mm	Pk 1000	$149.85
H 1440	12.7mm	Pk 10	$2.75
H 1445	12.7mm	Pk 100	$20.00
H 1447	12.7mm	Pk 1000	$173.75

Locking Wire Saddles

For directing & gathering cables. Self adjusting to various panel thicknesses. 4.8mm chassis hole required.
H = 14.4mm A = 17.9mm
B = 8.6mm Nylon



H 4180	Pk 10	$2.95
H 4182	Pk 100	$23.00

HARDWARE

Grommets

Cordgrip Grommets

To suit cables 7.4 - 8.2mm and up to 1.6mm chassis thickness — Nylon.

H 4270 Pk 10 **$2.80**

H 4272 Pk 100 **$20.50**

To suit cables 6.2 - 7.4mm and up to 2.5mm chassis thickness — Nylon.

H 4250 Pk 10 **$2.20**

H 4252 Pk 100 **$14.60**

To suit cables 7.4mm - 8.2mm and up to 3.2mm chassis thickness.

H 4280 Pk 10 **$2.80**

H 4282 Pk 100 **$20.50**

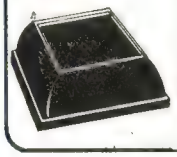
Rubber Grommets

For chassis to 16 gauge

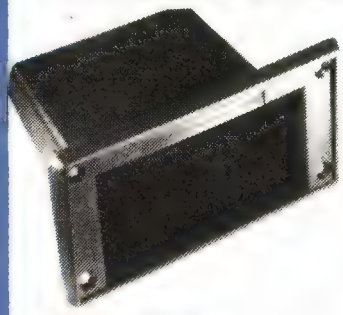
	Chassis Hole	Cable Hole	Pack Qty.	Price
H 1450	9.5mm	6.0mm	8	$3.45
H 1452	9.5mm	6.0mm	100	$20.70
H 1453	9.5m	6.0mm	1000	$170.00
H 1456	12.7mm	9.5mm	8	$3.75
H 1458	12.7mm	9.5mm	100	$24.95
H 1459	12.7mm	9.5mm	1000	$205.00

Save 40% With Bulk Pack

Rubber Feet



	Size	Pack Qty.	Price
H 0914	15mm	8	$3.40
H 0913	15mm	100	$21.95
H 0912	15mm	1000	$190.00
H 0917	20mm	8	$3.25
H 0916	20mm	100	$23.75
H 0915	20mm	1000	$255.00
H 0940	Stick on 12mm	4	$1.70
H 0942	Stick on 12mm	100	$27.95
H 0944	Stick on 12mm	1000	$230.00
H 0950	Stick on 20mm	4	$2.40
H 0952	Stick on 20mm	100	$44.95
H 0954	Stick on 20mm	1000	$370.00



Pocket Handle

Just the shot for heavy amp enclosures and speaker boxes. Cutout 48mm x 102mm.

H 1010 $2.95

Strap Handle

7" long all plastic matt black. Very strong, suitable for loads of over 300kg.

H 1020 $4.95

Velostat TN 3M Co.

Non-static sheeting for storing CMOS IC's LSI's etc. 1000 times better than aluminium foil. Will store up to 150 IC's (14 pin) on one 225mm x 150mm sheet.

H 0600 $5.95

Insulating Kits and Caps

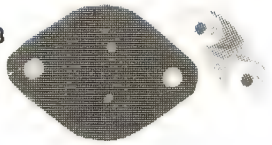
TO3 Insulating Kit

Mica washers and bushes for TO3 semi conductors.

Mounts

H 1580 Pk 4 **$2.50**

H 1582 Pk 100 **$31.95**



TO220 Insulating Kit

Mica Washers and bushes for TO220 or other flat pack Semis.

Mounts

H 1585 Pk 4 **$1.60**

H 1587 Pk 100 **$16.70**

H 1590 $.65 10 Up **$.60**

Led Mounts

New one piece type - quick to install.

H 1550 Pk 20 **$2.65**

H 1551 Pk 1000 **$89.95**

Bezel/Holder

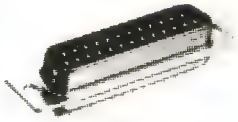
5mm Led Bezel/Holder with leg insulation (as shown) 9.5mm mounting hole required.

H 1560 Pk 10 **$2.95**

H 1565 Pk 100 **$24.50**

Panel Mounting & Locking Hardware For D Connectors

(Spacers & Screws packs of 100. Good for 50 D Connectors).



P 3310 Pk 10 **$4.95**

P 3312 Pk 100 **$39.95**

Where fail proof locking of cable mount D connector to mating chassis connector is desired, this is simply achieved by use of this screw/spacer set. The screws protrude through the rear of the D connector and chassis and mate with the front mounting threaded spacer. The locking screws incorporated with most D connector's backshells will now screw into the threaded spacers thus permanently securing the two connectors together.

Cable Clips

	Suits Cable Type	Pack	Price
H 1700	Fig 8 Cable	50	$5.95
H 1702	Fig 8 Cable	200	$21.95
H 1704	Fig 8 Cable	1000	$86.95
H 1710	Tele Cable	50	$5.95
H 1712	Tele Cable	200	$21.95
H 1714	Tele Cable	1000	$86.00
H 1720	Coax Cable	50	$6.95
H 1722	Coax Cable	200	$23.95
H 1724	Coax Cable	1000	$96.00
H 1730	7-9mm Cable	30	$4.55
H 1732	7-9mm Cable	200	$26.00
H 1734	7-9mm Cable	1000	$97.00
H 1740	10-12mm Cable	20	$3.75
H 1742	10-12mm Cable	200	$30.80
H 1744	10-12mm Cable	1000	$125.00

Save a heap on "Trade Packs"

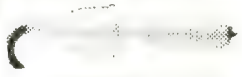
Fuse Holder 3AG
Panel Mount Standard

S 6000 $1.20
10 Up $1.10

Fuse Holder 3AG
Safety Type

S 5995 $1.90
10 Up $1.75

Fuse Holder
In Line Type With Leads

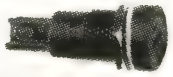


S 6001 $1.10
10 Up $1.00

Fuse Holder M205
Panel Mount Standard

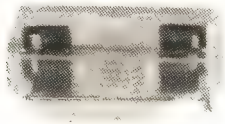
S 5990 $1.25
10 Up $1.15

Fuse Holder M205
Panel Mount Safety Type



S 5992 $1.75
10 Up $1.65

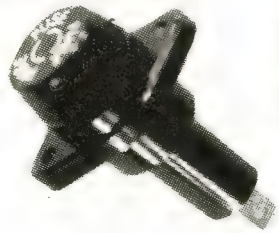
Fuse Holder M205
PCB Type With Cover



S 5985 .60
10 Up .50

PCB Mount Fuse Clips

3AG
S 5980 Pk. 8 **$1.60**
S 5981 Pk. 100 **$15.95**
M205
S 5983 Pk. 8 **$1.55**
S 5984 Pk. 100 **$14.95**



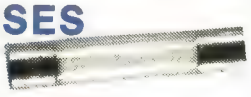
30 AMP PANEL MOUNT 5AG FUSE HOLDER

Remember the hassle in providing high current circuit protection? Well, here is the answer - our nifty panel mount fuse holder. It's like a big, big brother to the 3AG style. The 10mm x 38mm fuses are an industry's standard of course - naturally though ours cost somewhat less than industry standard prices.

		Ea	10 Up
S 6030	Holder	$4.45	$4.10
S 5975	Fuse 20A	$1.75	$1.60
S 5976	Fuse 25A	$1.75	$1.60
S 5977	Fuse 30A	$1.75	$1.60

FUSES

FUSES 3AG

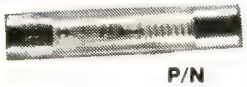


Value	P/N Pk. 10	P/N Pk. 100	P/N Pk. 1000
100mA	S 5770	S 5771	S 5772
150mA	S 5775	S 5776	S 5777
250mA	S 5780	S 5781	S 5782
500mA	S 5875	S 5786	S 5787
800mA	S 5790	S 5791	S 5792
1A	S 5975	S 5796	S 5797
1.5A	S 5800	S 5801	S 5802
2A	S 5805	S 5806	S 5807
3A	S 5810	S 5811	S 5812
5A	S 5815	S 5816	S 5817
7.5A	S 5820	S 5821	S 5822
10A	S 5825	S 5826	S 5827
15A	S 5830	S 5831	S 5832
20A	S 5835	S 5836	S 5837
25A	S 5840	S 5841	S 5842
30A	S 5845	S 5846	S 5847

FUSES M 205

Value	P/N Pk. 10	P/N Pk. 100	P/N Pk. 1000
100mA	S 5700	S 5701	S 5702
150mA	S 5705	S 5706	S 5707
250mA	S 5710	S 5711	S 5712
500mA	S 5715	S 5716	S 5717
800mA	S 5720	S 5721	S 5722
1A	S 5725	S 5726	S 5727
1.5A	S 5730	S 5731	S 5732
2A	S 5735	S 5736	S 5737
3A	S 5740	S 5741	S 5742
5A	S 5745	S 5746	S 5747
7.5A	S 5750	S 5751	S 5752
10A	S 5755	S 5756	S 5757

Fuse 3AG Time Delay (Slow Blow)



Value	P/N Ea	P/N Pk. 10	P/N Pk. 500
500mA	S 5860	S 5861	S 5862
1A	S 5865	S 5866	S 5867
1.5A	S 5870	S 5871	S 5872
2A	S 5875	S 5876	S 5877
3A	S 5880	S 5881	S 5882
5A	S 5885	S 5886	S 5887
7.5A	S 5890	S 5891	S 5892
10A	S 5895	S 5896	S 5897

Fuses supplied individually or in pack sizes as shown.

M 205/3AG

1-9	30c ea
10-99	28c ea
100-999	25c ea
1000+	20c ea

3AG SLOW BLOW

1-9	$1.65 ea
10-499	$1.45 ea
500+	$1.30 ea

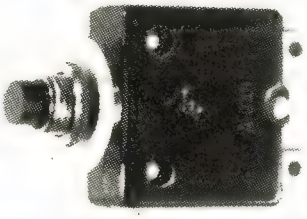
Circuit Breakers

Now there's no need to pay $10 or more for a circuit breaker. Altronics product is USA Underwriters Laboratories listed (and that speaks for itself) and once again is an Altronics Price Breakthrough.

Performance Data:
- Will hold 100% of rated current indefinitely at 25° C
- Will trip within 1 hour at 125% of load at 25° C
- Will trip within 4-40 seconds at 200% rated load.

S 5503	3 Amp
S 5505	5 Amp
S 5510	10 Amp
S 5515	15 Amp
S 5520	20 Amp
S 5525	25 Amp

All $4.50 ea 10 Up $4.20



Thermal Switch Circuit Breaker

Ideally suited to protect equipment from overheating. Simply position the thermal switch on the component to be protected and run the power supply via the quick connect tabs.

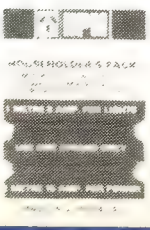
When the component reaches the cutout temperature it disconnects the power to the unit until it cools down then automatically resets itself.

Help protect transformers, output stages, power supplier etc. from self destruction through overheating.

Rated at 10A at 80° C

S 5610 $3.55 10 Up $3.45

Fuse Wire



Handy fuse wire card suitable for most household fuse boxes. Contains 8A wire for lights circuits and 15A for power circuits.

S 5900 $1.25

HARDWARE

Metric Round Head Screws, Nuts, Washers, Zinc Plated

		Pack	Price
H 3110	3 x 6mm	25	1.25
H 3115	3 x 6mm	200	4.20
H 3116	3 x 6mm	1000	6.60
H 3120	3 x 10mm	25	1.25
H 3125	3 x 10mm	200	4.50
H 3126	3 x 10mm	1000	8.45
H 3130	3 x 15mm	25	1.30
H 3135	3 x 15mm	200	4.95
H 3136	3 x 15mm	1000	10.40
H 3140	3 x 20mm	25	1.45
H 3145	3 x 20mm	200	6.20
H 3146	3 x 20mm	1000	15.95
H 3150	3 x 25mm	25	1.50
H 3155	3 x 25mm	200	7.40
H 3156	3 x 25mm	1000	21.30
H 3160	3 x 32mm	25	1.60
H 3165	3 x 32mm	200	8.50
H 3166	3 x 32mm	1000	26.20
H 3175	Nuts 3mm Hex	25	1.55
H 3177	Nuts 3mm Hex	200	6.95
H 3178	Nuts 3mm Hex	1000	19.50
H 3180	Washer 3mm Flat	25	1.35
H 3182	Washer 3mm Flat	200	4.65
H 3183	Washer 3mm Flat	1000	9.20
H 3185	Washer 3mm S/proof	25	1.55
H 3187	Washer 3mm S/proof	200	7.45
H 3188	Washer 3mm S/proof	1000	21.60
H 3310	4 x 10mm	25	1.55
H 3315	4 x 10mm	200	7.20
H 3316	4 x 10mm	1000	19.90
H 3320	4 x 15mm	25	1.60
H 3325	4 x 15mm	200	7.80
H 3326	4 x 15mm	1000	23.20
H 3380	Nuts 4mm Hex	25	1.45
H 3382	Nuts 4mm Hex	200	6.60
H 3383	Nuts 4mm Hex	1000	17.75
H 3385	Washer 4mm Flat	25	1.40
H 3387	Washer 4mm Flat	200	5.35
H 3388	Washer 4mm Flat	1000	12.25
H 3389	Washer 4mm S/proof	25	1.65
H 3391	Washer 4mm S/proof	200	7.95
H 3392	Washer 4mm S/proof	1000	24.20

Rack Nuts, Bolts & Washers

		Pack	Price
H 5385	Rack screw M6 silver	12	3.20
H 5386	Rack screw M6 silver	100	13.40
H 5387	Rack screw M6 silver	1000	99.30
H 5390	Rack screw M6 black	12	3.30
H 5391	Rack screw M6 black	100	14.00
H 5392	Rack screw M6 black	1000	105.50
H 5394	Captive nuts M6 No.6	1000	399.00
H 5395	Captive nuts M6 No.6	12	5.95
H 5396	Captive nuts M6 No.6	100	45.50
H 5398	Nylon washer suit M6	12	2.10
H 5399	Nylon washer suit M6	100	8.50
H 5397	Nylon washer suit M6	1000	69.60

Self Tapping Screws

		Pack	Price
H 1100	No. 4 x 6mm	25	2.40
H 1102	No. 4 x 6mm	200	5.95
H 1103	No. 4 x 6mm	1000	14.90
H 1110	No. 4 x 12mm	25	2.65
H 1112	No. 4 x 12mm	200	7.85
H 1113	No. 4 x 12mm	1000	15.50
H 1116	No. 6 x 9mm	25	2.65
H 1117	No. 6 x 9mm	200	7.80
H 1118	No. 6 x 9mm	1000	23.25
H 1120	No. 8 x 12mm	25	2.70
H 1122	No. 8 x 12mm	200	7.95
H 1123	No. 8 x 12mm	1000	27.50

Universal Head Self Tappers

H 1130	No. 6 x 9mm	25	2.85
H 1132	No. 6 x 9mm	200	9.25
H 1133	No. 6 x 9mm	1000	29.65
H 1140	No. 4 x 9mm	200	5.20
H 1141	No. 4 x 9mm	1000	11.65

Brass Spacers

Untapped 3mm Clearance

	Length	Pack	Price
H 1355	6mm	8	2.45
H 1359	6mm	100	9.90
H 1360	6mm	1000	69.25
H 1362	9mm	8	2.60
H 1365	9mm	100	11.75
H 1366	9mm	1000	84.65
H 1372	12mm	8	2.85
H 1373	12mm	100	14.30
H 1374	12mm	1000	107.75
H 1375	25mm	8	2.95
H 1376	25mm	100	24.50
H 1377	25mm	1000	199.00

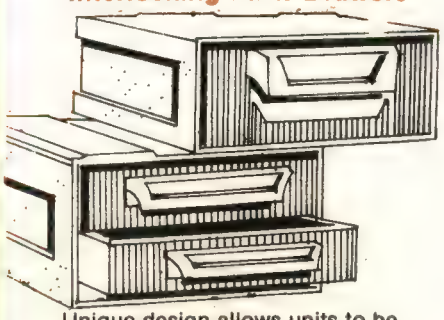
Tapped 3mm

H 1390	10mm	8	3.25
H 1391	10mm	100	19.40
H 1392	10mm	1000	153.20
H 1393	15mm	8	3.70
H 1394	15mm	100	24.80
H 1395	15mm	1000	199.00
H 1396	25mm	8	5.00
H 1397	25mm	100	41.20
H 1398	25mm	1000	347.80

Countersunk Socket Screw Allen Key Type

		Pack	Price
H 3410	Natural 4mm	25	1.70
H 3415	Natural 4mm	100	5.35
H 3416	Natural 4mm	1000	27.50
H 3420	Black 4mm	25	1.75
H 3425	Black 4mm	100	5.35
H 3426	Black 4mm	1000	27.50

Interlocking Parts Drawers



Unique design allows units to be "dovetailed" together. Drawers will not stick or seize. Single or double drawers available.

H 0235 single $4.95 10 Up $4.50
H 0236 double $4.95 10 Up $4.50

Utility Parts Case

Featuring a clear plastic lid so you can tell contents at a glance. Simple slide lock. 48 partition combinations. Very sturdy ABS plastic.

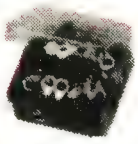
H 0249 $28.95

16 Way Parts Drawer Set

See through acrylic parts drawer. Slide-in ident. cards supplied. Sturdy steel construction. Value plus!

H 0240 $29.95

Crimp Terminals and Lugs



DIN WIRE SIZE A = .75 - 1.0
B = 1.5 - 2.5 **C** = 4 - 6

FEMALE QUICK CONNECT

Cat.	Description	Wire Size	Stud Size	Pk.	Price
H 2000	Kwik cnct. FEM.Red	A	6.3	8	1.70
H 2002	Kwik cnct. FEM.Red	A	6.3	100	18.15
H 2005	Kwik cnct. FEM.Blue	B	6.3	6	1.50
H 2007	Kwik cnct. FEM.Blue	B	6.3	100	18.15

MALE QUICK CONNECT

H 2020	Male Red	A	6.3	8	1.60
H 2022	Male Red	A	6.3	100	10.40
H 2025	Male Blue	B	6.3	6	1.50
H 2027	Male Blue	B	6.3	100	10.40

RING TYPE CRIMPLUG

H 2030	Red	A	3.5	8	1.50
H 2032	Red	A	3.5	100	10.40
H 2035	Red	B	4	8	1.60
H 2037	Red	B	4	100	10.40
H 2040	Red	A	5	8	1.75
H 2042	Red	A	5	100	10.40
H 2045	Blue	B	4	6	1.70
H 2047	Blue	B	4	100	13.75
H 2050	Blue	B	5	6	1.45
H 2052	Blue	B	5	100	13.75
H 2055	Blue	B	6	6	1.69
H 2057	Blue	B	6	100	17.25
H 2060	Yellow	C	5	4	1.45
H 2062	Yellow	C	5	50	10.40
H 2065	Yellow	C	6	4	1.69
H 2067	Yellow	C	6	50	10.75

SPADE CRIMPLUG

H 2070	Red	A	4	8	1.60
H 2072	Red	A	4	100	10.40
H 2075	Red	A	5	8	1.69
H 2077	Red	A	5	100	10.75
H 2080	Blue	B	4	6	1.76
H 2082	Blue	B	4	100	11.75
H 2085	Blue	B	5	6	1.45
H 2087	Blue	B	5	100	13.75

FEMALE BULLET CRIMPLUG

H 2120	Red	A	3.9	8	2.00
H 2122	Red	A	3.9	100	17.25
H 2125	Blue	B	3.9	8	2.00
H 2127	Blue	B	3.9	100	14.85

MALE BULLET CRIMPLUG

H 2150	Red	A	4	8	1.60
H 2152	Red	A	4	100	10.40
H 2155	Blue	B	4	8	1.60
H 2157	Blue	B	4	100	10.40

DOUBLE ADAPTOR
Connects 2 Females to 1 Male

H 2100	2M + 1F	6.3	6	1.60
H 2102	2M + 1F	6.3	100	13.75

PIGGYBACK "DOUBLE ADAPTOR"

Provides connection to male and allowing connection to additional female.

H 2010	Pig/bck F to M+F Red	A	6.3	4	1.45
H 2012	Pig/bck F to M+F Red	A	6.3	50	7.65
H 2015	Pig/bk F to M+F Blue	B	6.3	4	1.45
H 2017	Pig/bk F to M+F Blue	B	6.3	50	8.59

CABLE JOINER/SPLICER

H 2200	Splicer	B			1.50
H 2205	Splicer	B			3.99

SOLDER LUG

H 1500	solder lug	3	50	3.70
H 1501	solder lug	3	1K	27.50

250V Neon Flush Mount Indicators

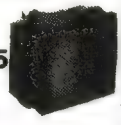
Single Red Indicator

Panel cutout 13mm x 19mm

S 4005 $1.75
10 Up $1.50

Dual Indication Red/Green

Dual indicator — Red & Green.
Panel cutout 19mm x 22mm
Complimentry to **S 3230** Switch.



S 4007 $3.95
10 Up $3.50

Minature Panel Neon

250V
Chrome Bezel Housing

S 4020 $3.25
10 Up $2.95

Standard Neon 250V

Panel Mount
Red

S 4015 $1.65
10 Up $1.45

Pigtail Neon

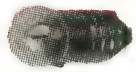
90-250V
S 4010 .45
10 Up .40

Led Bezel 2 Volt Chrome Bezel Housing

Red

S 4030 $1.50
10 Up $1.35
Green
S 4032 $.50
10 Up $1.35

Filament Globes

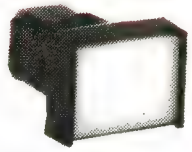


	10 Ea.	Up
S 4045 MES 6V	.45	.40
S 4047 MES 12V	.45	.40
S 4051 Lilliput 6V	.65	.60
S 4053 Lilliput 12V	.65	.60

MES GLOBE HOLDER

S 4055 MES Holder .45 .40

Panel Mount Indicator



S 1550 Red
S 1552 Green
S 1554 Yellow
S 1556 White
All $7.95 10 Up $7.25

Lamps to Suit
S 1580 12V
S 1585 24V
All $2.50 10 Up $2.25

For Panel layout see details in SWITCHES section

12v Panel Lamps

S 4025 Red
S 4026 Green
All $1.20 ea
10 up $1.10 ea

Xenon Tube

S 4040 $5.95
10 Up $5.25

Trigger Transformer

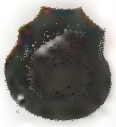
For S 4040
M 0104 $1.95
10 Up $1.60

For full range of illuminated switches see SWITCHES section in Index.

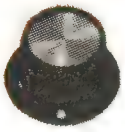
HARDWARE

Standard 1/4 Inch Shaft Type With Grubscrews

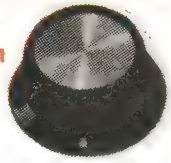
Black PVC 23mm
H 6050 .80
10 Up .75



Aluminium Cap Black PVC 24mm
H 6060 $1.35
10 Up $1.25



Aluminium Cap Black PVC 32mm
H 6066 $1.50
10 Up $1.35



Aluminium Cap Black PVC 20mm
H 6080 $1.40
10 Up $1.30

FANTASTIC VALUE

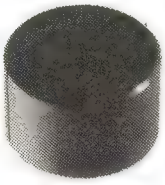
Polished Alum. 18mm
H 6305 $1.60
10 Up $1.45

Natural Alum.
H 6310 15mm $1.95
10 Up $1.80
H 6312 20mm $2.95
10 Up $2.45

Anodised Black
H 6202 15mm $1.55
10 Up $1.40

Brushed Black

		10 Up
H 6211 16mm	$1.90	$1.70
H 6213 22mm	$2.20	$2.00
H 6224 30mm	$2.15	$1.95
H 6228 40mm	$3.95	$3.60



Brushed Silver

		10 Up
H 6331 16mm	$1.95	$1.85
H 6333 22mm	$1.95	$1.80
H 6335 28mm	$2.55	$2.35

Knob 20mm Aluminium Cap 'push' on
H 6099 .50
10 Up .45

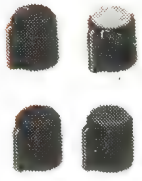
Calibrated 1 - 10
H 6090 $1.55
10 Up $1.40

Calibrated Line
H 6092 $1.55
10 Up $1.40

Colour Cap Series
15mm

H 6001	Red
H 6003	Blue
H 6005	Green
H 6007	Yellow

All .80
10 Up .75



Black PVC Fluted

H 6040 15mm .90 10 Up .85
H 6042 20mm $1.10 10 Up $1.00

Caps for Push Button Switch
Suits switch S 1410 and switch bank S 1430. Suits switch bank with 12.5mm pitch.

H 6610	White	35¢ 10 Up	30¢
H 6620	Grey	35¢ 10 Up	30¢
H 6630	Black	35¢ 10 Up	30¢
H 6640	Red	35¢ 10 Up	30¢

Metric Knobs For 18 Teeth Splined Shafts

H 6512 White $1.00 10 Up .90
Both 22mm O.D.

15mm Colour Cap
H 6501 .80
10 Up .75

Black PVC Fluted
H 6540 15mm .85 10 Up .80
H 6542 20mm .95 10 Up .90

40mm Brushed Black Aluminium
H 6229 $2.25
10 Up $2.10

Collett Knobs

(Note coloured caps purchased separately)

	Ea	10 Up
H 6410 15mm Grey 6mm shaft	$1.40	$1.30
H 6415 21mm Grey 6mm shaft	$1.70	$1.60
H 6420 15mm Grey 6.4mm shaft	$1.40	$1.30
H 6425 21mm Grey 6.4mm shaft	$1.70	$1.60

Collett Knob Caps

	1-9	10 Up
H 6440 15mm Red	.25	.20
H 6442 15mm Blue	.25	.20
H 6444 15mm Yellow	.25	.20
H 6446 15mm Green	.25	.20
H 6460 21mm Red	.30	.25
H 6462 21mm Blue	.30	.25
H 6464 21mm Yellow	.30	.25
H 6466 21mm Green	.30	.25

Base For Collett Knobs

	1-9	10 Up
H 6470 21mm Red	.25	.20
H 6472 21mm Blue	.25	.20
H 6474 21mm Yellow	.25	.20
H 6476 21mm Green	.25	.20

PHONEORDER TOLL FREE 008 999 007

Heatsink Front Panel

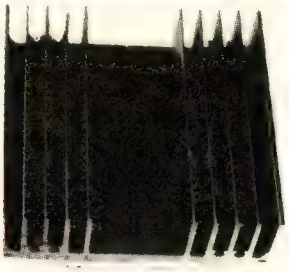
This high density multi finned cast heatsink has been made to the exact size of a 2 unit rack mount panel.
It has been designed for high power applications and is suitable for Power Amplifiers etc. up to 300W (music power).
Panel comes complete with cutout for rocker type power switch (13mm x 19mm). Suits S 3210, S 3217.
Dimensions: 483mm W x 89mm H Black finish 1.83kg.

H 0550 $89.00

New Generation

All Black Anodised

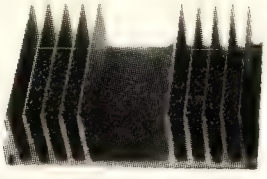
A brand new Altronics designed heatsink made right here in Australia.



This innovative design incorporates a number of recessed "channels" on the flat side to enable self tapper screw fixing from chassis etc. without the need to drill holes.
Other recesses are provided to mate with 1mm sheet metal thus allowing the construction of complete box enclosures with integral heatsinks with just four flat pieces of metal/aluminium etc.

Cat No	L	Thermal Res.	Ea.	4 Up
H 0580	75mm	1.4° C/W	$9.95	$9.10
H 0582	100mm	1.3° C/W	$11.80	$11.15
H 0585	125mm	1.2° C/W	$12.95	$12.15
H 0590	250mm	0.7° C/W	$24.50	$22.00
H 0592	300mm	.9° C/W	$27.50	$26.00

Versatile Heavy Duty

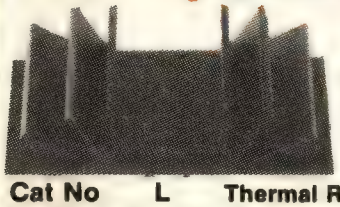


Heatsink has tongue and grooved ends enabling 'ganging' of heatsinks together.
Sizes: 110W x 33H x 72D
Thermal resistance 2.2° C/W

H 0560 Undrilled $6.95 10 Up $6.50
H 0561 Drilled 2 x TO3 $9.95 10 Up $9.50

Heatsink Size: 110W x 33H x 100D
H 0563 Undrilled $9.95 10 Up $9.50

High Efficiency Fan Type



Black Anodised - Undrilled
Five Handy Lengths

Cat No	L	Thermal Res.	Ea.	10 Up
H 0520	55mm	2.5° C/W	$5.50	$5.00
H 0522	72mm	2.2° C/W	$8.25	$7.75
H 0524	135mm	1.1° C/W	$9.95	$8.95
H 0526	225mm	0.9° C/W	$16.95	$15.50
H 0530	300mm	0.7° C/W	$19.95	$17.50

TO3 Minifin

50mm x 50mm x 25mm H
Prepared for TO3
Thermal resistance 5° C/W
H 0500 $2.90 10 Up $2.60

TO5

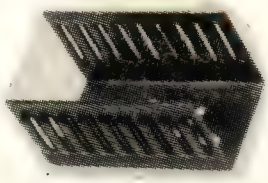
High efficiency press on
Thermal resistance 30° C/W
H 0512 $.60
10 Up $.50

Thermalloy TO3

H 0503 $1.50
10 Up $1.25

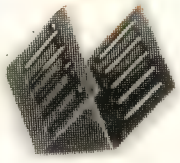
6/32 UNC Nut
for H 0503 Heatsink
H 0509 Pk 10 $.95
H 0508 Pk 100 $7.50

Universal U



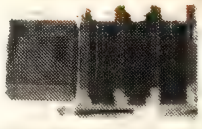
Use with flat pack
or TO3 package
Ideal for PC mounting
Thermal resistance 6° C/W
H 0501 $1.50
10 Up $1.35

Mini U



Low Cost -
Suits flat packs semis
Thermal resistance 10° C/W
H 0502 $.95
10 Up $.85

'Clip On' Type for TO-220 Package

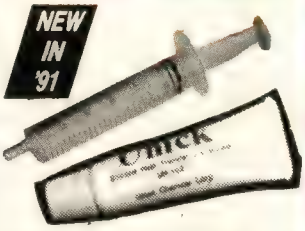


Multifin efficient design - simply push on over TO-220 Metal Tag Thermal Resistance 25° C/W
H 0505 $.75
10 Up $.68

Economy Power

102W x 25H x 72D
Black anodised
Thermal resistance 2.7° C/W
Undrilled
H 0570 $6.95 10 Up $6.50
Drilled 2 x TO3
H 0571 $7.50 10 Up $6.90

Heatsink Compound



Heat conductivity paste facilitates heat transfer from semi to heatsink. One small tube good for up to 20 to 30 packages.
Now available in handy syringe dispenser.

H 1600 10g	$3.20
H 1610 150g	$19.95
H 1615 Syringe	$9.95

PHONEORDER TOLL FREE 008 999 007

Australian Designed and Manufactured Professional Series Modular Rack Frames

Suitable for home or commercial use, these fantastic rack frames are durable strong, good looking, light weight and easy to assemble.

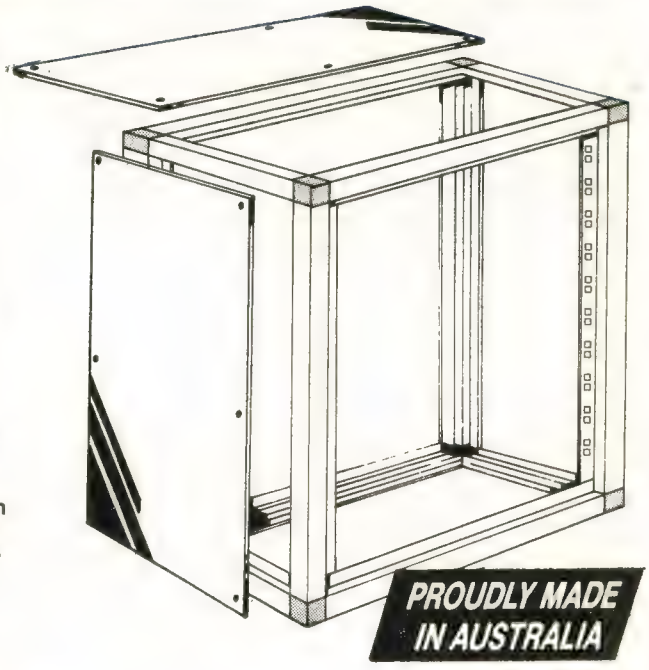
The frames are available in either Natural Anodised aluminium or Black Powder Coat aluminium and the side panels in Electric Blue or Black Powder Coat finish.

Ideal for use in home Hi-fi systems, Professional Audio installations, Band Gigs, Computer Patch panel etc.

Two colours to choose from:
Frames: Natural Anodised or Black Powder Coat
Panels: Electric Blue or Black Powder Coat.

Assembly. Each Frame System is supplied complete with 12 custom extruded anodised aluminium sections, 8 ABS corner connector pieces, 6 clip in M6 captive nuts and 6 M6 mounting screws. The sections and corner pieces simply push-fit together. A rubber or wooden mallet is recommended to fit together the self aligning pieces. Further strength can be obtained by pop riveting the various overlapping extruded sections if desired, although we hardly feel this is necessary.

Rack Frame Equipment Shelf: In some cases heavy equipment eg. large amplifiers tend to sag at the rear when installed in racks. With the addition of this shelf H 5359 it eliminates this tendency. Simply screws to the main frame. Also suitable for equipment that does not rack mount eg. C.D. players, tuners, videos etc.

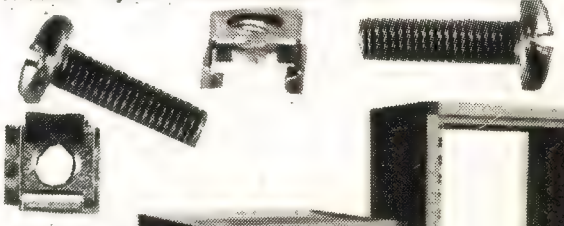


Rack frames and Panel Sets

		$ ea.	$ 4 Up
H 5204	Rack frame 4U (280mm) Nat.	139.00	130.00
H 5205	Panel set for H 5204	49.00	45.00
H 5206	Rack frame 6U (370mm) Nat.	149.00	140.00
H 5207	Panel set for H 5206	55.00	51.00
H 5212	Rack frame 12U (630mm) Nat.	169.00	158.00
H 5213	Panel set for H 5212	89.00	84.00
H 5218	Rack frame 18U (900mm) Nat.	189.00	182.00
H 5219	Panel set for H 5218	110.00	103.00
H 5230	Rack frame 30U (1450mm) Nat.	229.00	218.00
H 5231	Panel set for H 5230	159.00	152.00
H 5238	Rack frame 38U (1780mm) Nat.	269.00	258.00
H 5239	Panel set for H 5238	195.00	184.00
H 5304	Rack frame 4U (280mm) Black	139.00	130.00
H 5305	Rack panel for H 5304	49.00	45.00
H 5306	Rack frame 6U (370mm) Black	149.00	140.00
H 5307	Panel set for H 5306	55.00	51.00
H 5312	Rack frame 12U (630mm) Black	169.00	158.00
H 5313	Panel set for H 5312	89.00	84.00
H 5318	Rack frame 18U (900mm) Black	189.00	182.00
H 5319	Panel set for H 5318	110.00	103.00
H 5330	Rack frame 30U (1450mm) Black	229.00	218.00
H 5331	Panel set for H 5330	159.00	152.00
H 5338	Rack frame 38U (1780mm) Black	269.00	258.00
H 5339	Panel set for H 5338	195.00	184.00
H 5359	Equipment shelf	39.95	35.00

Front and Side Panel Fixing Hardware

		$ ea.	$ 4 Up
H 5385	Rack screw M6 Nat. Pk 12	3.20	2.88
H 5386	Rack screw M6 Nat. Pk 100	13.40	12.00
H 5387	Rack screw M6 Nat. Pk 1000	99.30	89.95
H 5390	Rack screw M6 Black Pk 12	3.30	2.96
H 5391	Rack screw M6 Black Pk 100	14.00	12.68
H 5392	Rack screw M6 Black Pk 1000	105.50	95.58
H 5394	Captive Nuts M6/No.6 Pk 1000	399.00	379.00
H 5395	Captive Nuts M6/No. 6 Pk 12	5.95	5.50
H 5396	Captive Nuts M6/No. 6 Pk 100	45.50	41.50
H 5397	Nylon Protect Washer Pk 1000	69.60	62.40
H 5398	Nylon Protect Washer Pk 12	2.10	1.85
H 5399	Nylon Protect Washer Pk 100	8.50	7.80

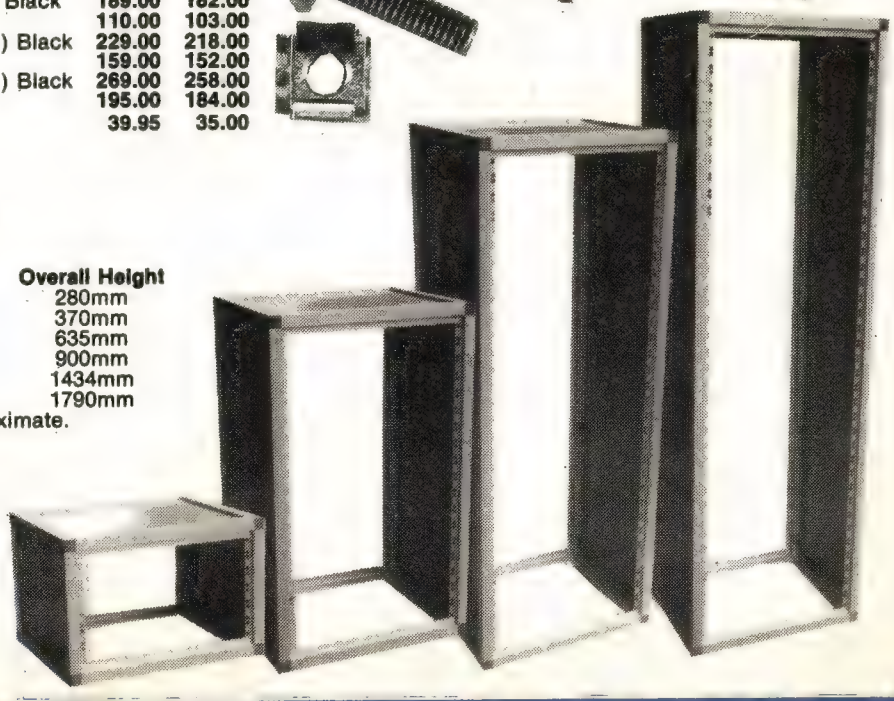


Rack Frame Data

1U (unit) = 44.45mm (1.75 inches)
Depth overall 450mm all models

	Panel Space	Overall Height
4u	180mm	280mm
6u	270mm	370mm
12u	535mm	635mm
18u	800mm	900mm
30u	1334mm	1434mm
38u	1690mm	1790mm

Note: These dimensions are approximate.



DISPLAYED HERE IN SEQUENCE LEFT TO RIGHT ARE:-
(A) H 5206 with H 5207
(B) H 5218 with H 5219
(C) H 5230 with H 5231
(D) H 5238 with H 5239

Heatsink Front Panel

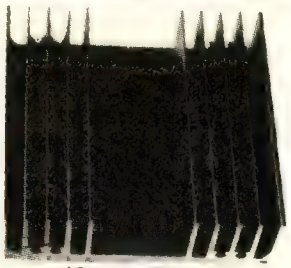
This high density multi finned cast heatsink has been made to the exact size of a 2 unit rack mount panel.
It has been designed for high power applications and is suitable for Power Amplifiers etc. up to 300W (music power).
Panel comes complete with cutout for rocker type power switch (13mm x 19mm). Suits S 3210, S 3217.
Dimensions: 483mm W x 89mm H Black finish 1.83kg.

H 0550 $89.00

New Generation

All Black Anodised

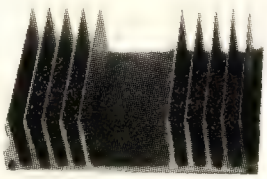
A brand new Altronics designed heatsink made right here in Australia.



This innovative design incorporates a number of recessed "channels" on the flat side to enable self tapper screw fixing from chassis etc. without the need to drill holes.
Other recesses are provided to mate with 1mm sheet metal thus allowing the construction of complete box enclosures with integral heatsinks with just four flat pieces of metal/aluminium etc.

Cat No	L	Thermal Res.	Ea.	4 Up
H 0580	75mm	1.4° C/W	$9.95	$9.10
H 0582	100mm	1.3° C/W	$11.80	$11.15
H 0585	125mm	1.2° C/W	$12.95	$12.15
H 0590	250mm	0.7° C/W	$24.50	$22.00
H 0592	300mm	.9° C/W	$27.50	$26.00

Versatile Heavy Duty

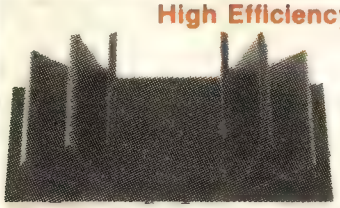


Heatsink has tongue and grooved ends enabling 'ganging' of heatsinks together.
Sizes: 110W x 33H x 72D
Thermal resistance 2.2° C/W

H 0560 Undrilled $6.95 10 Up $6.50
H 0561 Drilled 2 x TO3 $9.95 10 Up $9.50

Heatsink Size: 110W x 33H x 100D
H 0563 Undrilled $9.95 10 Up $9.50

High Efficiency Fan Type



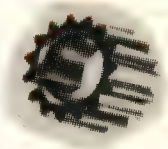
Black Anodised - Undrilled
Five Handy Lengths

Cat No	L	Thermal Res.	Ea.	10 Up
H 0520	55mm	2.5° C/W	$5.50	$5.00
H 0522	72mm	2.2° C/W	$8.25	$7.75
H 0524	135mm	1.1° C/W	$9.95	$8.95
H 0526	225mm	0.9° C/W	$16.95	$15.50
H 0530	300mm	0.7° C/W	$19.95	$17.50

TO3 Minifin

50mm x 50mm x 25mm H
Prepared for TO3
Thermal resistance 5° C/W
H 0500 $2.90 10 Up $2.60

TO5



High efficiency press on
Thermal resistance 30° C/W
H 0512 $.60
10 Up $.50

Thermalloy TO3

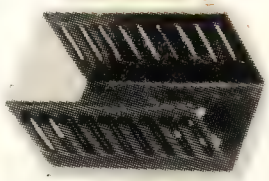
H 0503 $1.50
10 Up $1.25

6/32 UNC Nut
for H 0503 Heatsink
H 0509 Pk 10 $.95
H 0508 Pk 100 $7.50

Economy Power

102W x 25H x 72D
Black anodised
Thermal resistance 2.7° C/W
Undrilled
H 0570 $6.95 10 Up $6.50
Drilled 2 x TO3
H 0571 $7.50 10 Up $6.90

Universal U

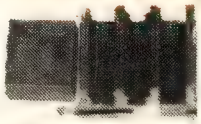


Use with flat pack
or TO3 package
Ideal for PC mounting
Thermal resistance 6° C/W
H 0501 $1.50
10 Up $1.35

Mini U

Low Cost -
Suits flat packs semis
Thermal resistance 10° C/W
H 0502 $.95
10 Up $.85

'Clip On' Type for TO-220 Package



Multifin efficient design - simply push on over TO-220 Metal Tag Thermal Resistance 25° C/W
H 0505 $.75
10 Up $.68

Heatsink Compound

Heat conductivity paste facilitates heat transfer from semi to heatsink. One small tube good for up to 20 to 30 packages.
Now available in handy syringe dispenser.

H 1600	10g	$3.20
H 1610	150g	$19.95
H 1615	Syringe	$9.95

ATTN: OEMs
Extruded heatsinks custom cut to your length requirements in this part's common quantities. Price per application. Delivery and setup from stock of [illegible]

Australian Designed and Manufactured Professional Series Modular Rack Frames

Suitable for home or commercial use, these fantastic rack frames are durable strong, good looking, light weight and easy to assemble.

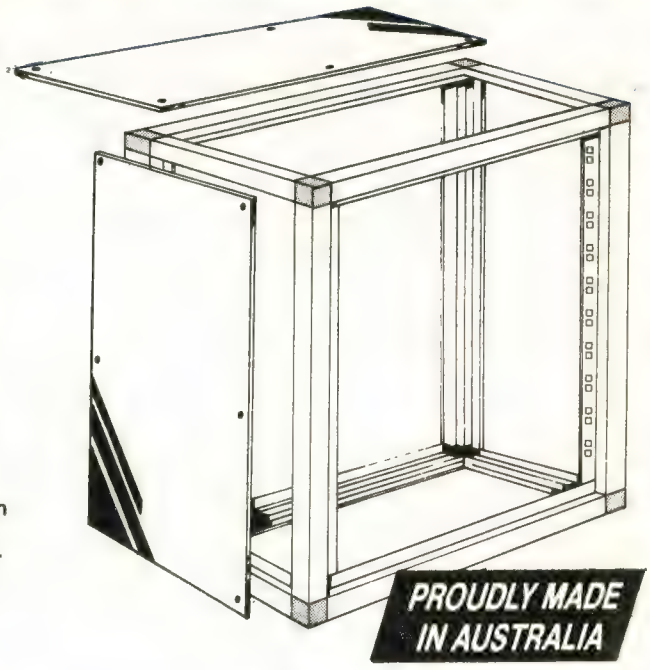
The frames are available in either Natural Anodised aluminium or Black Powder Coat aluminium and the side panels in Electric Blue or Black Powder Coat finish.

Ideal for use in home Hi-fi systems, Professional Audio installations, Band Gigs, Computer Patch panel etc.

Two colours to choose from:
Frames: Natural Anodised or Black Powder Coat
Panels: Electric Blue or Black Powder Coat.

Assembly. Each Frame System is supplied complete with 12 custom extruded anodised aluminium sections, 8 ABS corner connector pieces, 6 clip in M6 captive nuts and 6 M6 mounting screws. The sections and corner pieces simply push-fit together. A rubber or wooden mallet is recommended to fit together the self aligning pieces. Further strength can be obtained by pop riveting the various overlapping extruded sections if desired, although we hardly feel this is necessary.

Rack Frame Equipment Shelf: In some cases heavy equipment eg. large amplifiers tend to sag at the rear when installed in racks. With the addition of this shelf H 5359 it eliminates this tendency. Simply screws to the main frame. Also suitable for equipment that does not rack mount eg. C.D. players, tuners, videos etc.

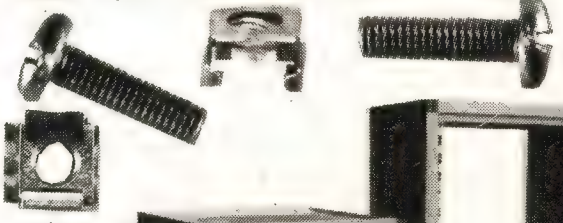


Rack frames and Panel Sets

		$ ea.	$ 4 Up
H 5204	Rack frame 4U (280mm) Nat.	139.00	130.00
H 5205	Panel set for H 5204	49.00	45.00
H 5206	Rack frame 6U (370mm) Nat.	149.00	140.00
H 5207	Panel set for H 5206	55.00	51.00
H 5212	Rack frame 12U (630mm) Nat.	169.00	158.00
H 5213	Panel set for H 5212	89.00	84.00
H 5218	Rack frame 18U (900mm) Nat.	189.00	182.00
H 5219	Panel set for H 5218	110.00	103.00
H 5230	Rack frame 30U (1450mm) Nat.	229.00	218.00
H 5231	Panel set for H 5230	159.00	152.00
H 5238	Rack frame 38U (1780mm) Nat.	269.00	258.00
H 5239	Panel set for H 5238	195.00	184.00
H 5304	Rack frame 4U (280mm) Black	139.00	130.00
H 5305	Rack panel for H 5304	49.00	45.00
H 5306	Rack frame 6U (370mm) Black	149.00	140.00
H 5307	Panel set for H 5306	55.00	51.00
H 5312	Rack frame 12U (630mm) Black	169.00	158.00
H 5313	Panel set for H 5312	89.00	84.00
H 5318	Rack frame 18U (900mm) Black	189.00	182.00
H 5319	Panel set for H 5318	110.00	103.00
H 5330	Rack frame 30U (1450mm) Black	229.00	218.00
H 5331	Panel set for H 5330	159.00	152.00
H 5338	Rack frame 38U (1780mm) Black	269.00	258.00
H 5339	Panel set for H 5338	195.00	184.00
H 5359	Equipment shelf	39.95	35.00

Front and Side Panel Fixing Hardware

		$ ea.	$ 4 Up
H 5385	Rack screw M6 Nat. Pk 12	3.20	2.88
H 5386	Rack screw M6 Nat. Pk 100	13.40	12.00
H 5387	Rack screw M6 Nat. Pk 1000	99.30	89.95
H 5390	Rack screw M6 Black Pk 12	3.30	2.96
H 5391	Rack screw M6 Black Pk 100	14.00	12.68
H 5392	Rack screw M6 Black Pk 1000	105.50	95.58
H 5394	Captive Nuts M6/No.6 Pk 1000	399.00	379.00
H 5395	Captive Nuts M6/No. 6 Pk 12	5.95	5.50
H 5396	Captive Nuts M6/No. 6 Pk 100	45.50	41.50
H 5397	Nylon Protect Washer Pk 1000	69.60	62.40
H 5398	Nylon Protect Washer Pk 12	2.10	1.85
H 5399	Nylon Protect Washer Pk 100	8.50	7.80

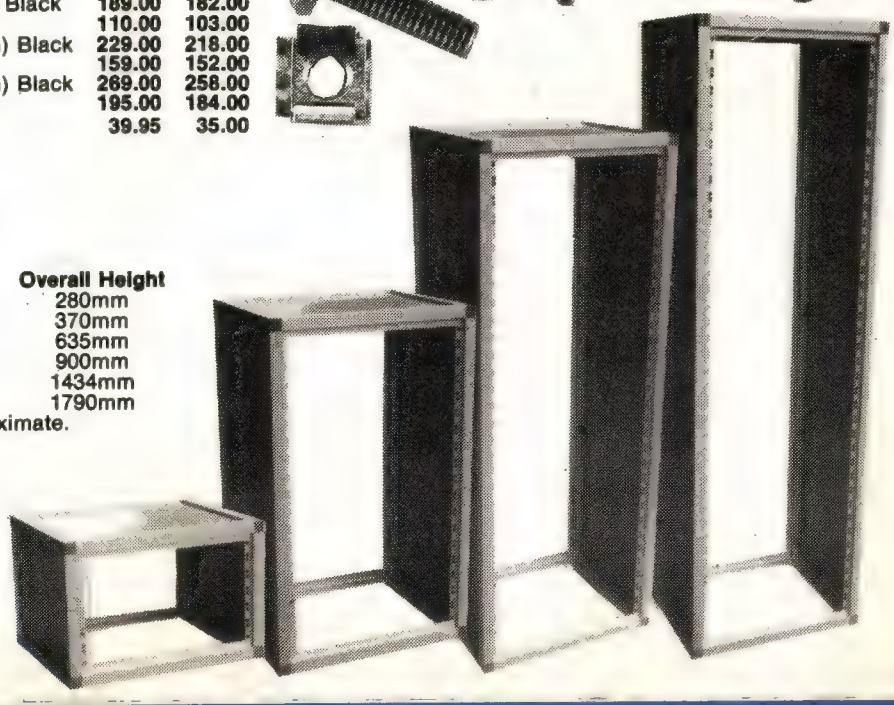


Rack Frame Data

1U (unit) = 44.45mm (1.75 inches)
Depth overall 450mm all models

	Panel Space	Overall Height
4u	180mm	280mm
6u	270mm	370mm
12u	535mm	635mm
18u	800mm	900mm
30u	1334mm	1434mm
38u	1690mm	1790mm

Note: These dimensions are approximate.



DISPLAYED HERE IN SEQUENCE LEFT TO RIGHT ARE:-
(A) H 5206 with H 5207
(B) H 5218 with H 5219
(C) H 5230 with H 5231
(D) H 5238 with H 5239

PHONEORDER TOLL FREE 008 999 007

Rack Cases

Now Available Nine Great New Models with Raw Aluminium, Natural or Black Anodising

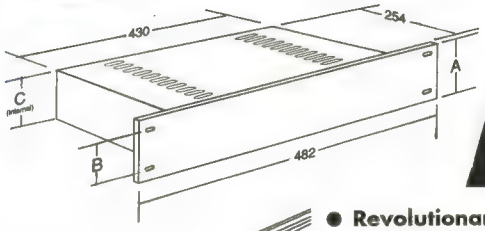
Each finish is available in 44mm, 88mm or 132mm high models. Mounting hole centres conform exactly to International Racking Specifications both vertically and horizontally.

FANTASTIC NEW MODEL DESIGNED BY ALTRONICS

Features:

- Raw aluminium, black or natural anodised finish.
- These beautifully crafted rack cabinet boxes will give your equipment a really 1st class appearance.
- Aluminium construction with removable top and bottom steel cover panels.
- All dimensions conforms to the International Standard.
- Ventilated lid.
- Deluxe finish front panel.
- Individually cartoned.
- Supplied in Flat Pack Form - Easily assembled in minutes.

PROUDLY MADE IN AUSTRALIA



NEW IN '91

Cat No.	Unit Height	A	B	C	Finish	Ea.	5 Up
H 5011	1U	44	32	38	Raw Alum.	59.95	57.95
H 5012	2U	88	76	79	Raw Alum.	78.95	76.95
H 5013	3U	132	54	122	Raw Alum.	82.95	80.95
H 5021	1U	44	32	38	Nat Anod.	65.95	63.95
H 5022	2U	88	76	79	Nat Anod.	82.95	80.95
H 5023	3U	132	54	122	Nat Anod.	89.95	87.95
H 5031	1U	44	32	38	Blk Anod.	65.95	63.95
H 5032	2U	88	76	79	Blk Anod.	82.95	80.95
H 5033	3U	132	54	122	Blk Anod.	89.95	87.95

Side Elevation:
D=254mm
C=Internal Chassis Height
B=Mounting Bolt Centres

- **Revolutionary new extruded design eliminates the need for visible boltheads through the front panel**

Economy Rack Cabinet

- Solid steel construction
- Black anodised front panel
- 3 unit (132mm)
- Conforms to International Standards
- Ventilated top and side panels

H 0400 ONLY $69.95 5 Up $65.00

Blank Rack Panels

Cat No.	Unit Height	Finish	Ea.	5 Up
H 5111	1U	Raw Alum.	9.95	9.45
H 5112	2U	Raw Alum.	17.95	16.95
H 5113	3U	Raw Alum.	25.95	24.95
H 5121	1U	Nat Anod.	12.95	11.95
H 5122	2U	Nat Anod.	20.95	19.95
H 5123	3U	Nat Anod.	27.95	26.95
H 5131	1U	Blk Anod.	13.95	12.95
H 5132	2U	Blk Anod.	22.95	21.95
H 5133	3U	Blk Anod.	29.95	28.95

High Energy Rack Case

Vented Lid Not Shown

PROUDLY MADE IN AUSTRALIA

Yet another innovation from the design team and Altronics. The use of super heavy duty heatsinks as rack case sides now allows a myriad of amplifiers, power supplies, battery chargers etc. to be built in an "Off the Shelf" rack case.

Fantastic for stereo amplifiers — Each heatsink will accommodate an audio output stage of approximately 120W with normal efficiency and dissipation.

A great chassis for heavy duty power supplies and battery charges. We suggest the mounting of rectifier bridge or diodes on one heatsink and the regulator devices on the other.

For very high heat dissipation this design allows the simple fitting of computer type fans to inside back of rear panel, adjacent to each respective heatsink. Fans are thus very cheap and easy to fit and provide very efficient cooling of the heatsink.

Heatsinks Altronics H 0590.
Front Panel 3 unit Rack size 480mm x 132mm x 3mm.
Base 1.0mm steel, ventilation slots provided.
Top Cover 1.0mm steel, ventilation slots provided.
Internal Dimensions 125mm x 370mm x 250mm.
External Dimensions 130mm x 440mm x 252mm plus standard front panel.

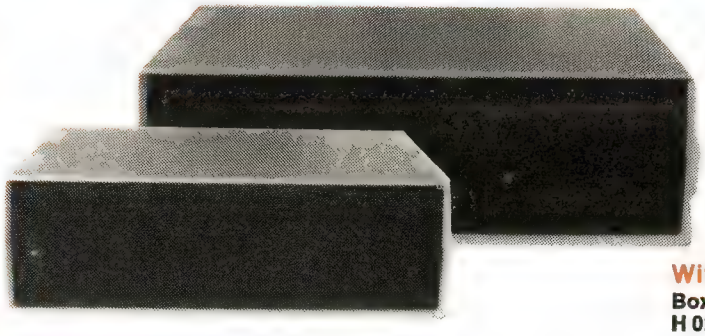
H 0417 Natural Anodised Aluminimum Front Panel $129.95 4 up $125.00

H 0418 Black Anodised Aluminium Front Panel $129.95 4 up $125.00

PHONEORDER TOLL FREE 008 999 007

BOXES/CASES

'ABS' INSTRUMENT CASES



H 0480/H 0481 **Overall size: 200 W x 160 D x 70 H**
H 0482/H 0483 **Overall size: 260 W x 190 D x 80 H**
(Vented Case)

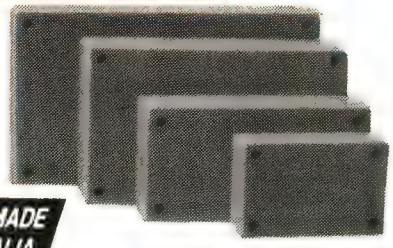
Internal mounting posts enable a wide combination of PCB's, transformers, etc. to be accommodated.
PCB guide rails provided internally allow verticle PCB positioning to several locations.
Removable front and rear panels. Attractive textured finish one side and plain the reverse side. (Enables direct engraving, silk screen printing, etc. to plain side),
Top and bottom split apart for ease of construction or service.
Integral feet included.

		EA	10 Up
H 0480	Light Grey with Black Panels	$15.65	$13.35
H 0481	Black Case with Black Panels	$15.65	$13.35
H 0482	Light Grey with Black Panels	$20.85	$18.79
H 0483	Black Case with Black Panels	$20.85	$18.79

ACCESSORIES

		1-9	10-99
H 0484	Nat. Al. Panel for H 0480/1	$3.95	$3.65
H 0485	'ABS' PVC Panel for H 0480/1	$1.65	$1.60
H 0486	Black Al. Panel for H 0480/1	$7.95	$7.45
H 0487	'ABS' PVC Panel for H 0482/3	$2.20	$1.98
H 0488	Blk. Al. Panel for H 0482/3	$9.95	$8.95
H 0489	Nat. Al. Panel for H 0482/3	$4.50	$4.15

JIFFY BOXES



PROUDLY MADE IN AUSTRALIA

With ABS Lid

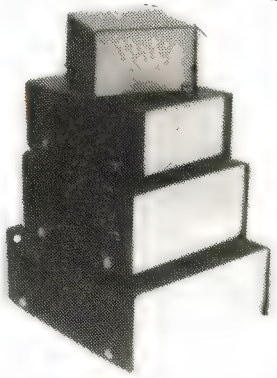
Box	Colour	Dimensions	PCB Trimmed Width Vert.	Horiz.	Price	10 Up
H 0201	Black	150 x 90 x 50	90	87	$3.95	$3.80
H 0202	Black	195 x 113 x 60	106	103	$6.95	$6.40
H 0203	Black	130 x 68 x 41	62	60	$3.50	$3.30
H 0205	Black	83 x 54 x 28	50	47	$2.50	$2.20
H 0151	Grey	150 x 90 x 50	90	87	$3.95	$3.80
H 0152	Grey	195 x 113 x 60	106	103	$6.95	$6.40
H 0153	Grey	130 x 68 x 41	62	60	$3.50	$3.30
H 0155	Grey	83 x 54 x 28	50	47	$2.50	$2.20

With Metal Lid

H 0103	Black	130 x 68 x 41	62	60	$2.95	$2.60
H 0105	Black	83 x 54 x 28	50	47	$2.25	$2.10

Deluxe Cabinets

Natural finish aluminium chassis with black steel ventilated cover. Fitted with 4 rubber feet.



83 x 66 x 102
H 0441 $6.75 10 Up $6.40
150 x 61 x 103
H 0442 $9.75 10 Up $9.25
150 x 76 x 34
H 0443 $12.00 10 Up $11.10
184 x 70 x 160
H 0444 $14.25 10 Up $13.30

Super Large Instrument Case

PROUDLY MADE IN AUSTRALIA

Hobbyists and manufactuers alike will find our new desk mounting case really fantastic for the larger projects. The case has generous ventilation slots on both the top and bottom panels, a myriad of mounting posts are provided for PCB's and "extra tough" mounting posts are included for securing transformers. Additional ventilation has also been provided for the mains transformer and power supply locality.

● Designed to house amplifiers, inverters, power supplies, micro-processor equipment, etc. ● Mounting posts provided for PCB's, transformers. ● Vented for efficient air-flow cooling. ● Extra tough, super finish front and rear panels. ● Dimensions: 355 x 250 x 122

H 0490 Grey Case
H 0491 Black Case or H 0492 Blue Case $39.95

ATTENTION MANUFACTURERS: Give your products a world class appearance with this fine Australian product. Call Altronic Distributors on 09 328 2199 for OEM rates.

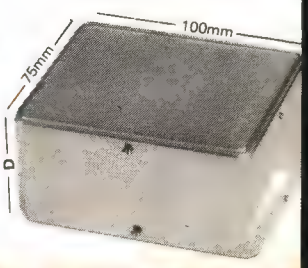
Horwood Cases

H 0461 Type 84/6/U
153 x 102 x 203mm
$29.95 10 Up $27.50
H 0463 Type 84/10/U
254 x 102 x 203mm
$30.95 10 Up $28.25
H 0465 Type 93/8/U
203 x 76 x 228mm
$26.50 10 Up $24.50
H 0468 Type 93/12/U
305 x 76 x 228mm
$34.50 10 Up $32.50

FANTASTIC VALUE

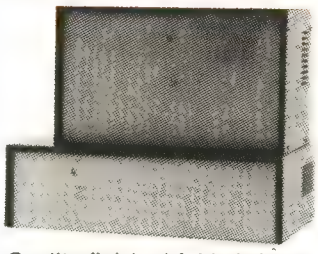
Horwood Utility Cases
Sturdy Extruded Construction

	D Dimension	EA	10 Up
H 0456	25mm	$8.95	$8.50
H 0457	50mm	$9.95	$9.50
H 0458	100mm	$11.50	$11.00
H 0459	150mm	$14.50	$13.50



PHONEORDER TOLL FREE 008 999 007

KW Instrument Cases



Quality finished folded sheet metal cabinets. The base is constructed from aluminium for easy "metal bashing" and finished in "frosty silver". The lid is steel, finished in blue hammer tone and is provided with generous ventilation slots. Combined they provide a sturdy good looking appearance.

Two models to choose from:

H 0496 (No. C 1066) **$25.95**
10 Up $24.50
(255 x 158 x 154mm)

H 0498 (No. C 1284) **$25.95**
10 Up $24.50
(305 x 90 x 204mm)

Aluminium Boxes

Made from 20 gauge aluminium there low cost enclosures are ideally suited for those small projects that don't require a million dollar finish.

Boxes are prepunched and supplied with lid fixing screws.

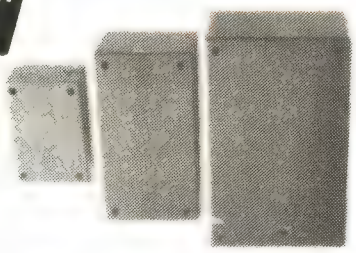
Two models to choose from:

H 0355 $4.70 10 Up $4.50
(100 x 58 x 454mm)

H 0358 $7.95 10 Up $7.15
(150 x 100 x 70mm)

NEW FOR '91

Die Cast Boxes



When you need a box that's rugged, robust and virtually indestructable then these have to be the answer. Apart from the sturdiness they also offer a high degree of RFI sheilding.

All models have inbuilt slots for accepting P.C.B.'s.

Three sizes to choose from:

H 0451 $7.95 10 Up $7.50
(98 x 50 x 25mm)

H 0453 $9.95 10 Up $9.20
(118 x 60 x 40mm)

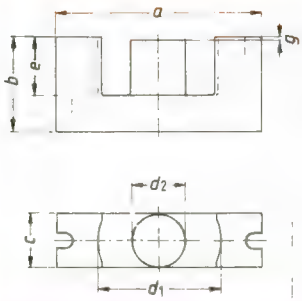
H 0455 $24.50 10 Up $23.10
(188 x 108 x 60mm)

Ferrite 'E' Cores and Formers

Siemens 'E' cores use Hi-quality N27 Siferrit material, featuring an extremely high flux density and a frequency range of 0 to 0.1MHz. Ideally suited to — ● Super compact power transformers ● Chokes ● Pulse transformers ● TV line transformers ● Transducers ● Ignition coils ● Interference suppressors, etc.

All coil formers are glass fibre, reinforced, thermoplastic, flame retardant polyester.

DIMENSIONS REFERENCE



SIEMENS EC-35

Built Dims - 47mm x 36mm x 26mm Core Pair Inc. Former

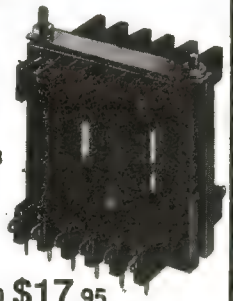
A 34.5
B 17.5
C 9.8
D1 22.8
D2 9.8
E 11.9

L 5050 $14.75
10 Up $14.15

SIEMENS EC-52

Built Dims - 58mm x 61mm x 44mm Core Pair inc. Former and Mount

A 52.2
B 24.4
C 13.8
D1 33
D2 13.8
E 15.5

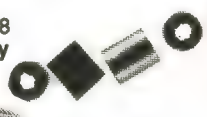


L 5060 $17.95
10 Up $16.95

Ferrite Suppression Beads

Size OD 4.0 x **ID** 2.0 x **L** 5.0mm **Material** F8 **Part No.** 35-032-28 **Alternating Frequency Range** 50KHz - 500KHz.

L 5250 .20 10 up .15



Transformer Pot Cores

Size OD x 25 **ID** 11.1 x **H** 15.9
Material F4 Ferrite
Equivalent to Fx 2240 pot core. As used in the Megohm Meter.

L 5305 Bobbin .95 10 Up .65

L 5300 Core $5.95 10 Up $5.45

Toroidal Cores

Our toroids are **'Powdered Iron'** type for excellent durability.

Size OD 14.8 x **ID** 8 x **H** 6.35
Grade 1003 **Part No.**17/732/22
Saturation flux density 15000 gauss **Max. operating frequency** 500 KHz

L 5110 $3.95
10 Up $3.75

Size OD 33 x **ID** 20 x **H** 10
Grade 1001
Part No. 17/742/10 **Saturation flux density** 15000 gauss **Max. operating frequency** 500KHz.

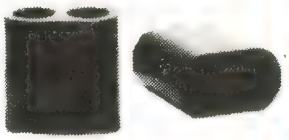
L 5120 $9.45
10 Up $9.15

Size OD 44 x **ID** 24 x **H** 16.5
Grade 1001 **Part No.** 17/745/10
Saturation flux density 15000 gauss **Max.operating frequency** 500KHz

L 5130 $11.75
10 Up $11.40

Balun Formers

Ideal for RF matching transformers and balanced mixers up to 250MHz in antenna feeders or in input circuits of VHF and TV receivers, i.e. 300 Ohm to 75 Ohm transformers or vice versa.



Balun Core (Large)

7.4mm x 13.2mm x 13.5mm
Part No. 1050/1/F14
Operating frequency 40 - 220MHz **Material** - F14

L 5230 .75ea 10 Up .65

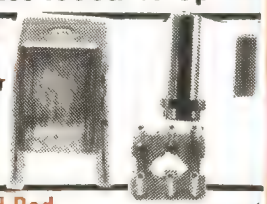
Balun Core (Small)

7.4mm x 13.2mm x 6.6mm
Part No. 1-5-/2/F14
Operating frequency 40 - 220MHz **Material** - F14

L 5235 .85ea 10 Up .80

Sub Miniature Former With Core, Can and Base

5mm type 722/1 - use with 4mm slug or as open air type. (As used in ET1760 Video Modulator)



L 5210 $1.95 10 Up $1.75

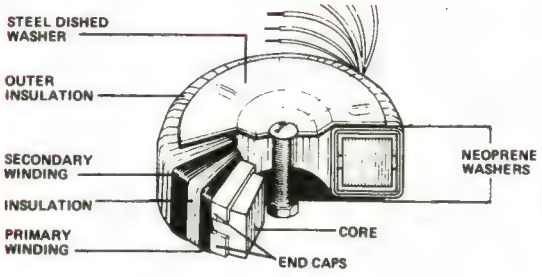
Ferrite Aerial Rod

Diameter 9mm Length 200mm
Material F16
Applications Long-Medium-Short Wavelength up to 12MHz. **Neosid Part No.** 9.5x200/F16

L 5240 $3.95 10 Up $3.65

TRANSFORMERS

Toroid Power Transformers



Why a Toroid?

- Smaller size and weight to meet modern "Slimline" requirements.
- Low electrically induced noise demanded by compact equipment.
- High efficiency enabling conservative rating whilst maintaining size advantages.
- Lower operating temperature. ● Simple, quick single bolt mounting.

The toroidal transformer is now accepted as the standard in industry, replacing the laminated type. Industry has been quick to recognise the advantages toroidals offer in size, weight, lower radiated field and, **thanks to Altronics - Low Price.**

Dimensions and Weight

80VA Models	90mm Diam.	35mm H. 0.9Kgs	Leads 200mm
160VA Models	100mm Diam.	40mm H. 1.5Kgs	Leads 200mm
300VA Models	110mm Diam.	55mm H. 2.4Kgs	Leads 200mm
500VA Models	135mm Diam.	60mm H. 3.9Kgs	Leads 200mm

NOTE: **SEC Current A** - current available where secondaries are connected in parallel.
SEC Current B - current available where secondaries are connected in series.

80VA RATING
All $49.95 5 up $47.00 ea.

Cat. No	Sec. V	SEC Current A	SEC Current B
M 3020	12+12	6.6	3.3
M 3025	18+18	4.4	2.2
M 3030	25+25	3.2	1.6
M 3035	30+30	2.6	1.3
M 3040	35+35	2.2	1.1

300VA RATING
All $89.95 5 up $86.00 ea.

Cat. No	Sec. V	SEC Current A	SEC Current B
M 3085	12+12	25.0	12.5
M 3086	18+18	16.67	8.33
M 3088	25+25	12.0	6.0
M 3090	30+30	10.0	5.0
M 3092	35+35	8.57	4.29
M 3100	40+40	7.5	3.75
M 3105	45+45	6.67	3.33

160VA RATING
All $65.00 5 up $59.00 ea.

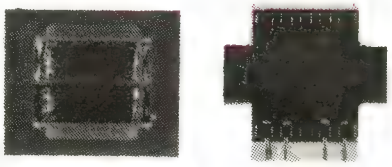
Cat. No.	Sec. V	SEC Current A	SEC Current B
M 3050	12+12	13.3	6.7
M 3055	18+18	8.9	4.45
M 3060	25+25	6.4	3.2
M 3065	30+30	5.3	2.7
M 3070	35+35	4.6	2.3
M 3075	40+40	4.0	2.0
M 3080	45+45	3.56	1.78

500VA RATING
All $129.00 5 up $125.00 ea.

Cat. No.	Sec. V	SEC Current A	SEC Current B
M 3120	30+30	16.6	8.3
M 3125	35+35	14.2	7.1
M 3130	40+40	12.5	6.2
M 3135	45+45	11.1	5.5
M 3140	50+50	10.0	5.0
M 3145	55+55	9.0	4.5
M 3150	60+60	8.3	4.10
M 3155	65+65	7.6	3.8

Special Function				
	M 3071	35+35+15+15	160VA	$79.95
	M 3200	Inverter	300VA	$115.00
	M 3205	Inverter	600VA	$180.00

PCB Mains

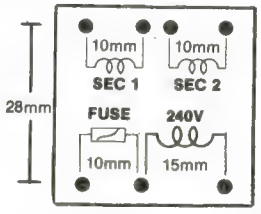


7VA Rating. Super compact wound on grain oriented steel core for high efficiency and low temperature rise.
Power Rating:
7VA Load Full voltage +3%-0%

Model	Prim/SEC's
M 7112	240/6+6
M 7115	240/7.5+7.5
M 7118	240/9+9
M 7124	240/12+12
M 7130	240/15+15

FANTASTIC VALUE

$12.95 ea
10 Up $11.50 ea



FUSE TYPE: Thermal 115° C

Height 37mm **Length** 48mm **Width** 40mm
PINOUT VIEWED FROM UNDERNEATH

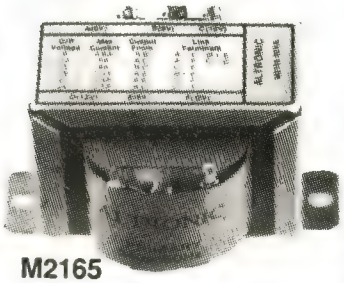
General Purpose Mains Transformers

All Mains Transformers Primaries 240V - Specifications listed refer to secondary windings

			EA	10 Up
M 2851	12.6V CT	150mA	5.95	5.50
M 2852	12.6V CT	300mA	7.65	6.95
M 2853	12.6V CT	500mA	8.95	8.45
M 2854	24V CT	150mA	5.95	5.45
M 2855	30V CT	150mA	6.95	6.50
M 2154	12V, 15V, 18V, at	1 Amp	12.50	11.50
M 2155	6V3,7V5,8V5 9V5,12V6, 15V at	1 Amp	10.95	10.25
M 2156	6,9,12, 15V at	2 Amps	17.95	16.50
M 6872	15,17V5,20, 24,25V5, 30V at	1 Amp	16.50	15.00

GENERAL PURPOSE MAINS TRANSFORMERS

All Mains Transformers Primaries 240V - Specifications listed refer to secondary windings



M2165

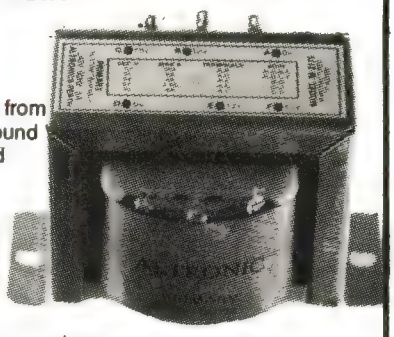
Ea $26.50 10 Up $23.00

Multipurpose 60 VA Transformer

Output Two simple secondaries, each with just one tap, permit an amazing range of outputs.
240V to 9,12,15,18,21,24, volts at 60VA (60W).
Use of high grade silicon steel has enabled surprisingly compact dimensions

Multipurpose 120VA Transformer

Another quality transformer from Altronics. The M 2175 is wound on expensive grain oriented steel. Look at the size!

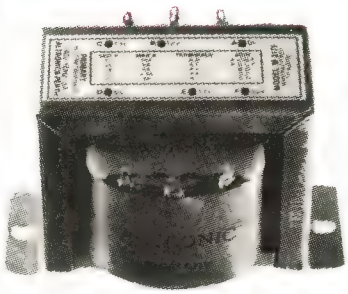


Primary: 240V
Secondary:

12V	10A
15V	8A
24V	5A
27V	4.4A
30V	4A

M 2175 EA $39.95 10 Up $37.00

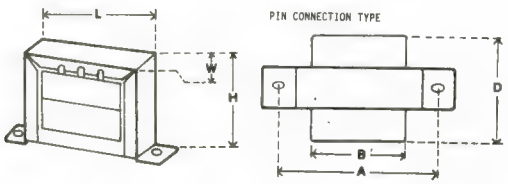
Multipurpose 100VA Transformer



Smaller version of M 2175, also wound on expensive grain oriented steel, with even smaller dimensions.
Primary: 240V
Secondary

12V	8.3A
15V	6.6A
24V	4.1A
27V	3.7A
30V	3.3A

M 2170 $29.95
10 Up $26.50



	A	B	D	L	W	H
M 1106	56	28	41	44	11	35
M 1109	56	28	38	43	17	35
M 1120	69	38	47	59	23	50
M 1125	82	44	48	70	22	59
M 1130	70	38	52	59	29	50
M 1135	80	44	62	78	40	59
M 2851	51	29	37	44	19	37
M 2853	65	29	44	50	28	42
M 2855	51	29	42	43	23	36
M 2154	72	38	50	60	32	51
M 2155	70	37	49	59	28	48
M 2156	80	43	64	69	40	57
M 2165	80	43	88	69	55	57
M 2170	97	48	80	79	43	64
M 2175	115	62	83	99	43	84
M 6672	80	43	62	69	39	59

Audio

Low Cost Miniature Transformers
Ideal for Hobbyist Projects. Intercoms, Transistor replacements - 450mV rated.

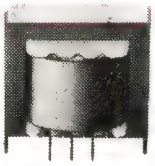
Coupling Type
M 0212 10K/2 Kct
M 0216 1Kct/8 Ohm

$2.95 ea
10 Up $2.70

Output Type
M 0222 3Kct/3K
M 0226 500ct/8 Ohm

$2.95 ea
10 Up $2.70

Low Cost Line Input



Max. Input Level + 12dbm
Ideal input coupling transformer enables DC isolation of various modules therefore preventing hum pickup etc.
Wide Freq. Res. 30Hz-30kHz
Nominal Imp. Ratio 10K : 10K (1:1) Ideal for coupling from 600 Ohm lines to amplifier input stages etc.

M 0710 $7.50
10 Up $6.90

40 Watt Attenuator

Used with 100v or 70V line PA systems enables user to tap from the line the required level. Taps are spaced in 4.5db steps. Power rating 40 watts RMS.

Professional grade grain oriented steel.
Primary Taps:
0V, 4.2V, 9.7V, 16.2V, 32.5V, 51.2V, 100V.
Frequency Res.: 70-18kHz

M 0440 $18.00
10 Up $15.50

MU Metal Shielded Audio

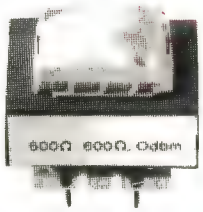
Microphone Type
Primary: 200 Ohm
Secondary: 50K Ohm. A high quality item eminently suited to mixers, PA amplifiers and where an ultra low "hum" pickup level is desired.

M 0701 $34.95
10 Up $33.00

Bridging/Isolating Type
Use for coupling audio modules. Prevents earth loops, hum etc. Essential coupling device where DC isolating is required. Nominal impedance ratio 10K:10K (1:1)

M 0702 $34.95
10 Up $33.00

Telecom Type Line Isolating Transformer



May be used to provide isolation between Telecom Australia lines and mains operated equipment. Telecom approved to specifications 1053 and 1054.
Impedance: 600 Ohm line/600 Ohm equipment.
Turns Ratio: 1:1
Max Level: 0 dbm @ 300 Hz
Insertion Loss: 1db max @ 0dbm, 300 Hz-5 kHz Freq. Res: 300 Hz-10 kHz +/- 1db, 0dbm, 0 D.C. Return Loss: less than 15db, 300 Hz-5 kHz.
Max Unbalanced DC: 60mA (200 mA without damage).
Proof Test: 4 KV RMS between windings & windings to core.
Weight: 150g

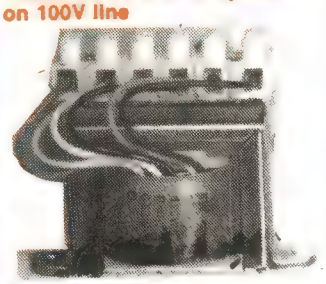
M 1000 $13.95
10 Up $13.00

TRANSFORMERS

TRANSFORMERS

Speaker Transformers

5 Watt Multi-Tap Speaker Transformer with Bracket & Terminal Strip with 5 Tapped Primaries for 8 Ohm speaker on 100V line



Wound on professional grade grain oriented steel core for extended frequency.
Freq. Res: 30Hz-20kHz
Mounting Hole Centres: 51mm Designed for use with high grade constant voltage 100V and 70V PA Systems. (Note: Power out is halved on 70V Line).

Primary Tap	Colour	Power
2K	Red	5W
4K	Green	2.5W
8K	Black	1.25W
16K	White	.66W
32K	Yellow	.33W
Common	Blue	

M 1106 $12.50
10 Up $11.00

5 Watt Speaker Transformer with 4 Tapped Primaries for 8 Ohm speaker on 100V line

Wound on professional grade grain orientated steel core for extended frequency response.
Freq. Res.: 30Hz-20kHz
Mounting Hole Centres: 51mm. Designed for use with high grade constant voltage 100V and 70V PA Systems. (Note power out is halved on 70V Line).

M 1109 $8.50
10 Up $7.80

Primary Tap	Power
20K	.5W
10K	1W
5K	2W
2K	5W
Common	

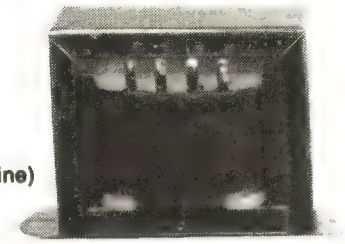
High Power Speaker Transformers

Wound on high grade grain oriented steel for extended frequency response. Used in PA applications where it is necessary for high powered 100V or 70V line.

20 Watt

Primary Taps	Power
500	20W
666	15W
1K	10W
2K	.5W
4K	2.5W
8K	1.25W

(Half power out for 70V line)
Secondary Taps 4,8 & 16Ohm

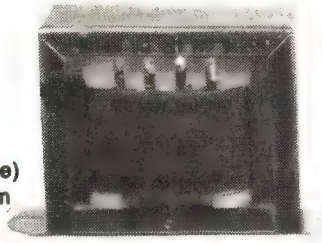


M 1120 $19.50
10 Up $18.00

30 Watt

Primary Taps	Power
320	30W
500	20W
1K	10W

(Half power out for 70V line)
Secondary Taps 4 & 8 Ohm

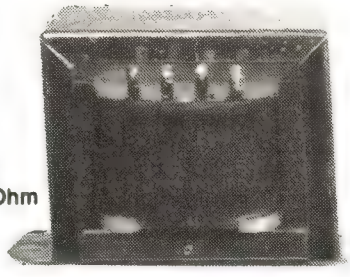


M 1125 $24.50
10 Up $23.50

40 Watt

Primary Taps	Power
250	40W
500	20W
1K	10W
2K	.5W

(Half these for 70V line)
Secondary Taps 4 & 8 Ohm

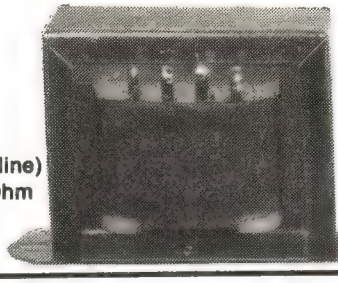


M 1130 $27.50
10 Up $24.00

60 Watt

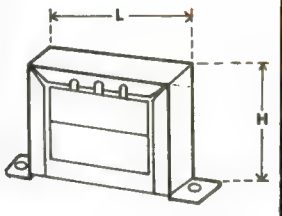
Primary Taps	Power
160	60W
320	30W
480	20W

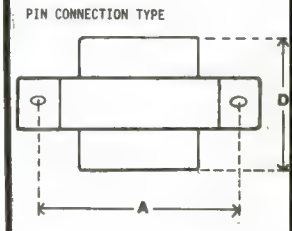
(Half power out for 70V line)
Secondary Taps 4 & 8 Ohm



M 1135 $39.50
10 Up $37.50

Physical dimensions for audio transformers



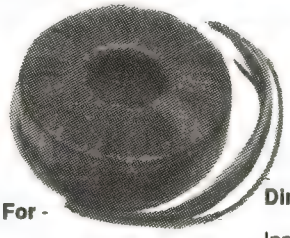


	A	D	L	H
M 1106	56	41	44	35
M 1109	56	38	43	35
M 1120	69	47	59	50
M 1125	82	48	70	59
M 1130	70	52	59	50
M 1135	80	62	78	59

For additional dimensions refer to chart on page 79 lower left hand corner.

* * * * *

Attention



HIGH POWER AUDIO 150W

Fantastic For -

(A) High Power Speaker Systems, sound columns.
(B) Amplifier output line transformer.
Superb Quality Transformer wound on low loss Toroid Core.
Max Power: 150 Watt
Frequency Response: 20Hz to 20 KHz

Dimensions: 125 Diam.45mm H, 2.5Kg's Leads 200mm

	Connected in Series	Connected in Par
Input Windings	100V	50V
Output Windings	16Ohm	4Ohm

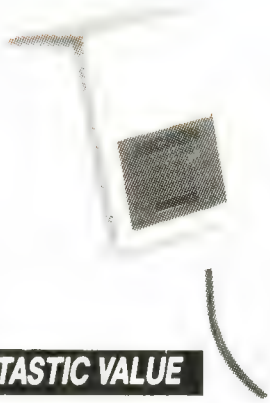
M 1124 $110.00 10 Up $104.00

Notes:
(1) The Role of Input and Output windings can be reversed.
(2) Input and Output windings can be configured differently i
Input windings series connected for 100V and Output windin
paralleled for 4 Ohm.

PHONEORDER TOLL FREE 008 999 007

AC Adaptors

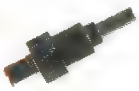
Our range of adaptors are each fitted with a 1.8M lead, in line socket and M 9014 2.5mm DC connector. Should your appliance require a different connector you may select from the adaptor plugs M 9013, to M 9015 illustrated. The adaptor plug is normally set for -ve ground. This may be changed to +ve ground by simply reversing the plug adaptor to the line socket.



FANTASTIC VALUE

Cat. No.	Output Volts.		Max. Current	
M 9000	3,4.5,6,7.5,9,12	DC	300mA	$19.95
M 9001	6	DC	300mA	$15.95
M 9002	12	DC	300mA	$15.95
M 9004	9	DC	300mA	$15.95
M 9005	6,9,12	DC	500mA	$22.50
M 9009	15V	AC	100mA	$9.95
M 9020	12V	AC	500mA	$16.95
M 9022	12V	DC	1 Amp	$22.50
M 9025	16V	AC	1 Amp	$19.95

DC Output Adaptor Plugs Available



M 9013 2.1mm DC Plug
M 9014 2.5mm DC Plug
M 9015 3.5mm DC Plug

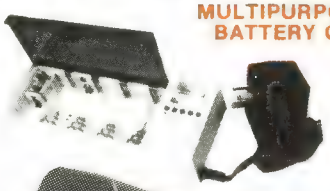
All **$1.95** 10 Up **$1.75**

Low Cost Nicad Battery Charger

This charger is supplied with 4 and 8 way battery holders and 9V battery snap to allow charging of these 3 different configurations. A 3 way selector switch is provided on the charger pack to allow selection as desired i.e. 6V at 45mA, 12V at 45mA & 9V at 10mA.

M 8005 $19.95

MULTIPURPOSE NICAD BATTERY CHARGER



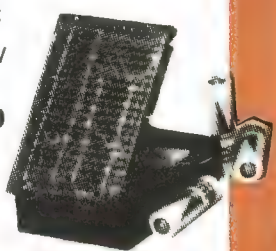
Charges every conceivable Nicad battery from AAA through 9V.

M 8010 $32.50

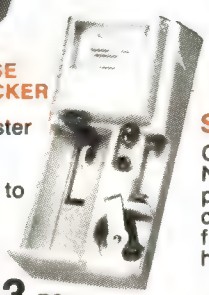
GELL CELL CHARGER

Charging current 300mA at 12V. Great for any 12V Gell Cell.

M 8020 $12.50



ALL PURPOSE BATTERY CHECKER



Pocket size tester will check just about every battery known to modern man!

Get One For Home Now

A 0930 $13.50

Solar Charger

Charges up to 4 AA Nicads by simply placing in sun light. Will charge from dead flat to fully charged in 8-10 hours average sunlight.

A 0230 $14.95

500mA REGULATED POWER SUPPLY

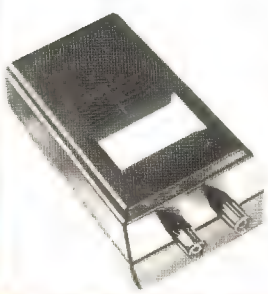
Input Voltage: 240V AC 50Hz
Output Voltage: 3, 4.5, 6, 7.5, 9, 12V DC
Output Current: 500mA

M 9040 $32.50

1 AMP POWER SUPPLY

Input Voltage: 240V AC 50Hz
Output Voltage: 6, 7.5, 9, 12V DC
Output Current: 1 AMP

M 9030 $46.95



2 AMP REGULATED POWER SUPPLY

Input Voltage: 240V AC 50Hz
Output Voltage: 12V DC +/- 0.5V
Output Current: 2A DC
Dimensions: 84 x 68 x 200m/m
Weight: 1.2Kgs

M 9050 $69.95

300 Watt Inverter 12V DC to 240V AC

Fantastic pre-built new model will power lights, TV, camping fridge, electric shaver and a whole host of other appliances.

Great for camping, out in the bush and any place where 240V is not available.

Features

FANTASTIC VALUE

- Binding post terminals for easy 12V connection to your car or truck battery.
- 300W output will power a multitude of appliances
- Appliance is simply 'plugged in' via built in 240V power point
- Complete with over current circuit breaker
- Fused 240V output
- Built in panel meter to monitor output voltage
- Strong steel case and chassis.

M 8120 $199.00

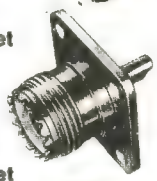
See Page 9 for Our Range of Inverter Kits

CONNECTORS

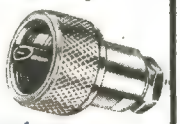
UHF Connectors

UHF Sockets

P 0508 Fem/Fem Coupler (PL259) Ea $2.50 10 Up $2.10



P 0509 Socket Sq.mount (S0239) Ea $1.75 10 Up$1.55



P 0510 Socket round mnt. (S0239) Ea $2.40 10 Up $2.20

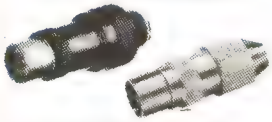
UHF Connectors

P 0502 PL259 (Suit RG58 Coax) Ea $2.15 10 Up $1.95

P 0503 (Suit RG8 Coax) PL259 Ea $1.95 10 Up $1.75

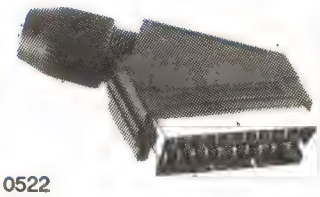
P 0504 Reducer (For P 0503) Ea .65 10 Up .60

75 Ohm Connectors



P 0227 Metal Plug $1.80
P 0228 Plastic Plug .95
P 0229 Chassis Skt. .95
P 0230 Line Skt. $1.65

Scart Plug

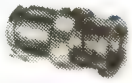


P 0522
21 Pin
$3.95 10 Up $3.60

Car Antenna Plug & Socket

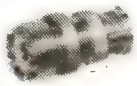
	Ea	10 Up
P 0185 Plug	.80	.75
P 0236 Socket	.85	.80

BNC Plugs & Sockets



	Ea	10 Up
P 0514 Plug (Solder)	$2.50	$2.30
P 0515 Socket (4 hole)	$2.60	$2.40
P 0516 Socket (1 hole)	$2.70	$2.50
P 0518 Socket (Panel Mount Insul)	$3.95	$3.45
P 0519 Socket (PCB Mount)	$5.95	$5.70
P 0520 Plug (crimp)	$2.15	$1.95

BNC-UHF-RF Adaptors



	Male	Female	Ea.
P 0378	BNC	PL259	$3.95
P 0380	PL259	BNC	$4.50
P 0385	BNC	RCA	$2.95
P 0390	BNC	BNC	$2.60
P 0392	3way'T'	BNC fem	$4.50
P 0394	BNC	2 way BNC	$6.95

RCA Connectors

PCB Mount RCA

P 0237 .95
10 Up .90

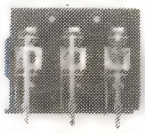
Chassis Mount RCA

P 0231 $.85
10 Up $.75

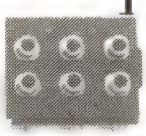
Insulated RCA Sockets

P 0232 2 Way
Ea .75 10 Up .70

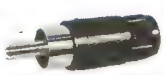
P 0234 4 Way
Ea $1.30
10 Up $1.20



P 0235 3 x 2 Way PC Mnt.
Ea $3.50
10 Up $3.35



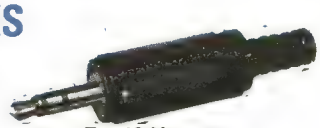
RCA Connectors Line Type



	Ea	10 Up
P 0140 Plug Red	.50	.45
P 0141 Plug Black	.50	.45
P 0215 Socket Red	.50	.45
P 0216 Socket Black	.50	.45

JACKS

Miniature Jacks

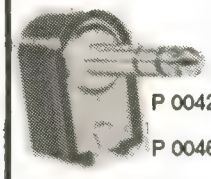


	Ea	10 Up
P 0020 2.5mm (Jack Mono)	.55	.50
P 0026 3.5mm (Jack Red Mono)	.60	.55
P 0028 3.5mm (Jack Black Mono)	.60	.55
P 0030 3.5mm (Stereo Jack)	.95	.90

Standard 6.3mm Jacks

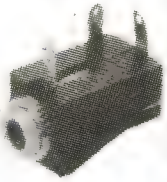
	Ea	10 Up
(Mono Plastic)		
P 0040 Plug 6.35mm	.90	.85
(Stereo Plastic)		
P 0044 Plug 6.35mm	$1.20	$1.10
(Mono Metal)		
P 0050 Plug 6.35mm	$1.40	$1.30
(Stereo Metal)		
P 0055 Plug 6.35mm	$1.80	$1.65

Right Angle Jack Plugs



	Ea	10 Up
P 0042 6.35mm Mono	$1.60	$1.40
P 0046 6.35mm Stereo	$1.90	$1.70

Miniature Panel Mount Sockets



	Ea.	10 Up
P 0088 Socket 2.5mm mono	$.55	$.50
P 0090 Socket 3.5mm mono	$.55	$.50
P 0092 Socket 3.5mm stereo	$1.35	$1.25

STD 6.35mm Jack Sockets Quality Enclosed Type

	Ea	10 Up
P 0065 Mono Switched	$1.90	$1.70
P 0068 Stereo	$1.90	$1.70
P 0072 Stereo DPDT SW	$1.95	$1.75
P 0074 Stereo DPDT SW Ins	$2.50	$2.25
P 0075 Stereo SPST SW Ins	$1.95	$1.75
P 0076 Stereo PCB Mount	$2.30	$2.10

Inline Jack Sockets

		Ea.	10 Up
P 0078	6.35mm Mono	$1.15	$1.00
P 0080	6.35mm Stereo	$1.35	$1.25
P 0082	3.5mm Mono	.90	.80
P 0084	3.5mm Stereo	.95	.85

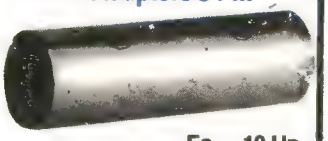
Plug Adaptors

	Plug	Socket	
P 0300	6.35mm Stereo	3.5mm Stereo	$1.50
P 0310	6.35mm Stereo	3.5mm Mono	$1.50
P 0320	3.5mm Stereo	6.35mm Stereo	$1.50
P 0330	6.35mm Mono	3.5mm Mono	$1.50
P 0340	3.5mm Stereo	3.5mm Mono	$1.50
P 0350	3.5mm Mono	3.5mm Stereo	$1.50
P 0360	3.5mm Mono	6.35mm Mono	$1.50
P 0370	3.5mm Mono	6.35mm Stereo	$1.50
P 0372	1x3.5 Stereo	2xRCA	$2.45
P 0373	1xRCA	2xRCA	$1.95
P 0374	1x6.3 Stereo	2xRCA	$2.75
P 0375	1x3.5 Stereo	2x3.5 Mono	$3.50

Cannon Type

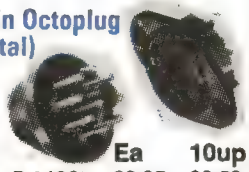
	Ea	10 up
P 0960 3 Pin Line Male	$5.50	$4.95
P 0962 3 Pin Chassis Male	$4.95	$4.45
P 0964 3 Pin Line Female	$6.95	$6.45
P 0966 3 Pin Chassis Female	$6.50	$5.90

Cannon to Cannon Type Adaptors 3 Pin



	Ea	10 Up
P 0972 Male/Male	$9.95	$8.95
P 0980 Fem/Fem	$19.95	$17.95

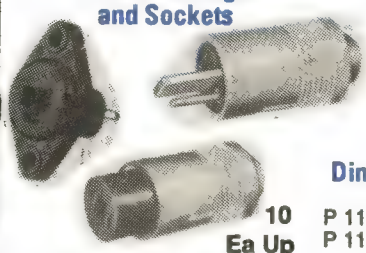
8 Pin Octoplug (Octal)



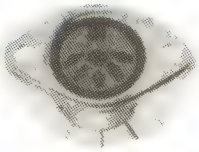
	Ea	10up
Plug P 0192	$3.95	$3.50
Socket P 0193	$3.95	$3.50

Din Connectors

2 Pin Din Plugs and Sockets



Din Sockets



		Ea	10 Up
P 1120	Line Plug	.60	.55
P 0222	Line Socket	.60	.55
P 0221	ChassisSkt.	.60	.55

Din Chassis Sockets

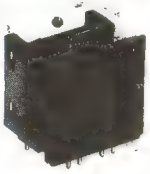
	Ea	10 Up
P 1170 3 Pin 180°	$1.20	$1.10
P 1175 4 Pin 220°	$1.95	$1.75
P 1178 5 Pin 180°	$1.20	$1.10
P 1180 6 Pin 240°	$1.40	$1.25
P 1182 7 Pin 270°	$1.60	$1.45
P 1184 8 Pin 270°	$2.50	$2.30

Din Line Plugs

		Ea	10 Up
P 1145	3 Pin 180°	.75	.70
P 1148	4 Pin 220°	.85	.80
P 1150	5 Pin 180°	.85	.80
P 1151	Metal Version	2.95	2.65
P 1152	5 Pin 240°	.85	.80
P 1156	6 Pin 240°	$1.10	.98
P 1159	7 Pin 270°	$1.10	.98
P 1162	8 Pin 270°	$1.40	$1.20

PCB Mount Socket

P 1188
5 Pin 180°
$1.50ea
10 Up $1.35ea



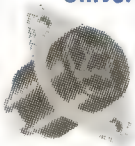
Din Line Sockets

		Ea	10Up
P 0220	5 Pin 180°	$1.20	$1.10
P 0225	6 Pin 240°	$1.10	.99
P 0226	7 Pin 270°	$1.10	.98

Right Angle 5 Pin Din Line Plug

P 1154
5 Pin 180°
$3.45 ea
10 Up $2.95

Universal 5 Pin



		Ea	10 Up
P 0186	Plug 240°	$1.00	.90
P 0190	Socket 240°	.95	.90

Panel Mount Screw Terminals

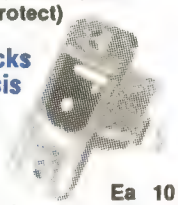
	Ea	10 Up
P 2020 2 Way	.80	.75
P 2022 4 Way	$1.30	$1.15

12 Way Terminal Block

250v Rated

	Ea	10 Up
P 2100	$1.99	$1.85
P 2110 (wire protect)	$3.99	$3.45

DC Jacks (Chassis Male)



	Ea	10 Up
P 0223 2.1mm Pin	.75	.70
P 0224 2.5mm Pin	.75	.70

DC Jacks (Female Line)

	Ea	10 Up
P 0134 2.1mm	.75	.70
P 0135 2.5mm	.75	.70

Car Cigarette Lighter Plug

	Ea	10 Up
P 0158 Plug with Fuse	$1.95	$1.75
P 0155 Socket	$2.20	$1.98
P 0160 Plug	.95	.85

Crocodile Clips

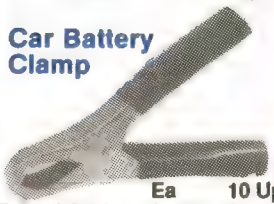
Mini

	Ea	10 Up
P 0100 Red	.50	.45
P 0101 Black	.50	.45

Medium

	Ea	10 Up
P 0110 Red	.55	.50
P 0111 Black	.55	.50

Car Battery Clamp



	Ea	10 Up
P 0012 Red	$1.65	$1.40
P 0013 Black	$1.65	$1.40

9V Battery Snap

	Ea	10 Up
P 0455	.30	.25

* * * * *

For a complete range of cables and wires suitable for use with our range of plugs, sockets and connectors refer to our Cables and Wire section in this catalogue.

* * * * *

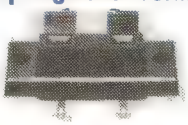
Attention

Manufacturers, Distributors and Bulk Users. Ring our Wholesale Office on 09-328 2199 for competitive rates on Bulk Quantities.

* * * * *

Terminals & Tag Strips

Spring Lever Terminals



		Ea.	10 Up
P 2010	2 way rect.	$1.65	$1.55
P 2012	4 way rect.	$2.45	$2.15
P 2011	2 Way rnd. 75mm dia.	$2.95	$2.75

PCB Mount Screw Terminals

	Ea	10 Up
P 2090 4 Way	$2.25	$1.95
P 2092 6 Way	$2.95	$2.45
P 2094 8 Way	$3.50	$3.20
P 2096 10 Way	$4.20	$3.80
P 2098 12 Way	$4.95	$4.50

Tag Strips

	Ea	10 Up
P 2203 3 Way	.35	.30
P 2205 5 Way	.40	.35
P 2209 9 Way	.80	.75

PCB Terminal Block

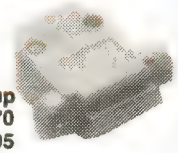
5mm Pin Pitch

	Ea	10 Up
P 2032 2 Way	.85	.75
P 2033 3 Way	$1.15	$1.10
P 2042 45° 2 Way	$1.25	$1.15
P 2043 45° 3 Way	$1.50	$1.35
P 2062 90° 2 Way	$1.10	.99
P 2063 90° 3 Way	$1.50	$1.35
P 2074 4 Way	$2.45	$2.20
P 2076 6 Way	$2.95	$2.70
P 2078 8 Way	$4.25	$3.75

Thru Panel Barrier

CONNECTORS

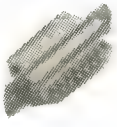
D Series Computer Connectors. Gold Plated



Professional Series

DB9		Ea	10 up
P 3000	Male 9 Pin	$2.95	$2.70
P 3010	Female 9 Pin	$3.25	$2.95
P 3020	Male PCB Rt/L	$3.75	$3.50
P 3030	Female PCB Rt/L	$4.50	$4.30
P 3040	Male PCB mnt.	$2.95	$2.75
P 3050	Female PCB Mnt.	$3.95	$3.60
P 3090	Backshell cover	$1.95	$1.80

DB15		Ea	10 Up
P 3100	Male 15 Pin	$3.25	$2.75
P 3110	Female 15 Pin	$3.85	$3.30
P 3120	Male PCB Rt/L	$4.35	$4.10
P 3130	Female PCB Rt/L	$5.50	$4.60
P 3140	Male PCB Mnt.	$5.50	$4.60
P 3150	Female PCB	$2.95	$2.90
P 3190	Backshell cover	$2.20	$1.95



DB25		Ea	10 Up
P 3200	Male 25 Pin	$4.95	$4.40
P 3210	Female 25 Pin	$5.50	$4.95
P 3220	Male PCB Rt/L	$4.95	$4.50
P 3230	Female PCB Rt/L	$6.90	$6.50
P 3240	Male PCB Mnt.	$4.95	$4.50
P 3250	Female PCB Mnt.	$6.25	$5.70
P 3290	Backshell cover	$2.50	$2.20

Spacer Screw Packs for 'D' Series Connectors

P 3310 Pack 10 **$4.95**
P 3312 Pack 100 **$39.95**

White PVC Wall Plate With D 25 Cutouts

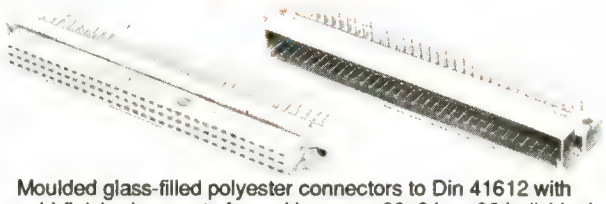
		Ea	10 Up
P 0766	Single	$1.80	$1.60
P 0767	Double	$1.95	$1.75

Centronics Plug 36 Way

Used universally with computer printers etc.

		Ea	10 Up
P 0770	Solder Type	$9.95	$8.95
P 0772	IDC Cable Type Male	$9.95	$8.95
P 0774	IDC Cable Type Female	$10.95	$9.95

Din 41612 2 Part "C Body" Edge Connectors



Moulded glass-filled polyester connectors to Din 41612 with gold-finished contacts for making up to 32, 64, or 96 individual connections to PCB's. The plug moulding houses single piece 90° angled pins on a 0.1 in pitch between rows, allowing horizontal mounting on Eurocards whilst the mating sockets have flow solder (4mm) spills. 64-way AC plugs and sockets are 96-way shells without the centre row of contacts. Individual polarisation between plug and socket pairs is obtained by moulded polarising tabs.

Technical Specifications

Base of foot to row B. Centre line typical 3.5mm
Proof Voltage: 1000V DC min.
Max. Current Per Contact: 1.5A
Contact Resistance: 15m Ohm max.
Insulation Resistance: 10^{12} Ohm min.
Temperature Range: 55° C to + 125° C
Insertion Force per way: 95g
Extraction Force per way: 95g

Plugs Right Angle PCB Mount

		Ea	10 Up
P 4832	32 Way - Rows A + C	$4.50	$4.10
P 4864	64 Way - Rows A + C	$9.65	$9.15
P 4896	96 Way - Rows ABC	$12.50	$11.50

Sockets Straight Pins 4mm

		Ea	10 Up
P 4932	32 Way - Rows A + C	$7.50	$6.95
P 4964	64 Way - Rows A + C	$13.95	$13.15
P 4996	96 Way - Rows ABC	$17.50	$16.00

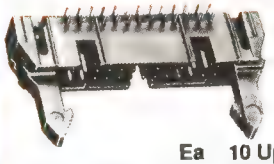
34 Way Double Sided Edge Connectors

For Disc Drives etc. 0.1" Pitch

P 0780 **$3.95** 10 Up **$3.45**

PCB Mounting Headers With Locking Levers

90 Degree Type

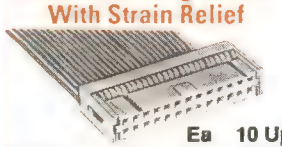


		Ea	10 Up
P 5210	10 Pin	$2.50	$2.25
P 5216	16 Pin	$2.95	$2.75
P 5220	20 Pin	$3.50	$3.25
P 5226	26 Pin	$3.95	$3.60
P 5234	34 Pin	$4.50	$4.20
P 5250	50 Pin	$5.50	$5.10

Straight Type

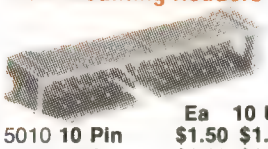
		Ea	10 Up
P 5110	10 Pin	$2.50	$2.25
P 5116	16 Pin	$2.95	$2.75
P 5120	20 Pin	$3.50	$3.25
P 5126	26 Pin	$3.95	$3.60
P 5134	34 Pin	$4.50	$4.20
P 5150	50 Pin	$4.95	$4.50

Cable Mounting Socket With Strain Relief



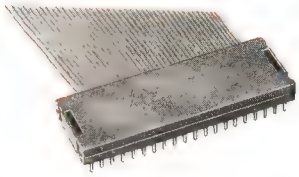
		Ea	10 Up
P 5310	10 Pin	$1.95	$1.75
P 5316	16 Pin	$2.25	$2.00
P 5320	20 Pin	$2.50	$2.25
P 5326	26 Pin	$3.95	$3.75
P 5334	34 Pin	$4.50	$4.20
P 5350	50 Pin	$4.95	$4.50

PCB Mounting Headers



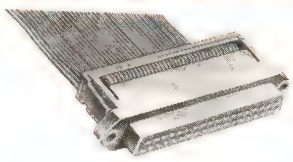
		Ea	10 Up
P 5010	10 Pin	$1.50	$1.35
P 5016	16 Pin	$1.95	$1.75
P 5020	20 Pin	$2.50	$2.25
P 5026	26 Pin	$4.50	$4.10
P 5034	34 Pin	$4.95	$4.50
P 5050	50 Pin	$5.50	$5.10
P 5051	50 Pin 90°	$5.65	$5.25

IDC DIL Plug Headers



		Ea	10 Up
P 4200	14 Pin	$2.45	$1.95
P 4210	16 Pin	$2.65	$2.30
P 4220	24 Pin	$3.95	$3.70
P 4225	28 Pin	$4.50	$4.10
P 4230	40 Pin	$6.50	$5.95

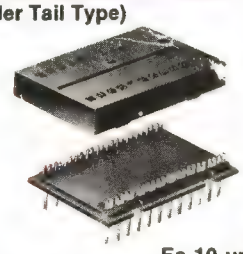
IDC "D" Range Connectors



		Ea	10 Up
P 4140	25P Male	$7.95	$7.15
P 4150	25P Fem.	$8.50	$7.80

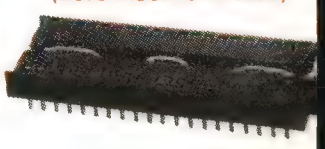
DIL Header Plugs

Plug into standard IC socket (Solder Tail Type)



		Ea	10 up
P 0614	14 Pin	$3.95	$3.45
P 0616	16 Pin	$4.50	$3.95
P 0624	24 Pin	$6.45	$6.15

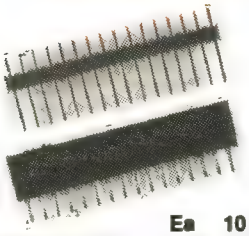
ZIF Sockets (Zero Insertion Force)



		Ea	10 Up
P 0650	24 Pin	$12.50	$11.50
P 0655	32 Pin	$14.50	$13.10
P 0657	40 Pin	$17.50	$16.10

PHONEORDER TOLL FREE 008 999 007

Transition Connector 16 Way 2.5mm pitch



		Ea	10 Up
P 2516	Male	$1.50	$1.35
P 2518	Female	$2.50	$2.30

Mating Pin Length 8mm
Solder Tail Length 3.5mm

Molex Pin Sockets

Use with single pins to .5mm diam.
Make your own sockets for IC's displays, LSI's etc.
P 0680

Pack of 100 **$4.95**

P 0681

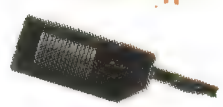
Pack of 1000 **$44.00**

Multimeter Plugs

Cross Hole

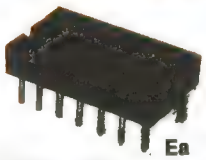
		Ea	10Up
P 0274	Red	$1.40	1.30
P 0276	Black	$1.40	1.30

Stack Type



		Ea	10Up
P 0282	Red	$1.60	1.50
P 0284	Black	$1.60	1.50

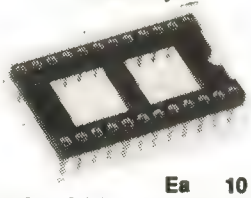
IC Sockets Dil Low Profile



		Ea	10 Up
P 0550	8 Pin	.30	.25
P 0560	14 Pin	.40	.35
P 0565	16 Pin	.45	.40
P 0567	18 Pin	.45	.40
P 0568	20 Pin	.50	.45
P 0570	24 Pin	.65	.60
P 0572	28 Pin	.75	.70
P 0575	40 Pin	.95	.80
Wire Wrap		**Ea**	**10 Up**
P 0578	8 Pin	$2.50	$2.15
P 0580	14 Pin	$3.85	$3.50
P 0585	16 Pin	$4.50	$4.25
P 0590	18 Pin	$4.95	$4.65
P 0595	24 Pin	$5.95	$5.45
P 0598	40 Pin	$10.95	$10.00

Machined Pin Gold Plated IC Sockets

For applications demanding 100% long life contact reliability.



		Ea	10 Up
P 0530	8 Pin	$1.10	$1.00
P 0532	14 Pin	$1.45	$1.35
P 0534	16 Pin	$1.65	$1.55
P 0536	18 Pin	$1.80	$1.70
P 0538	20 Pin	$2.00	$1.85
P 0540	24 Pin	$2.45	$2.30
P 0542	28 Pin	$2.80	$2.65
P 0544	40 Pin	$3.25	$3.00

16 Pin IC Test Clip

Makes connection to DIL IC's easy without the danger of shorting out pins. Use on 8, 14 or 16 pin IC's. Spring loaded.

P 0670 **$14.50**

IC Test Clips

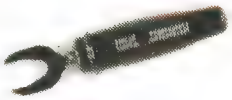
57mm Overall Length

		Ea	10 Up
P 0180	Red	$1.10	$1.00
P 0181	Black	$1.10	$1.00

Probe type IC Test clips which slip on to the end of meter leads.

		Ea	10 Up
P 0182	Red Probe	$1.20	$1.00
P 0183	Black Probe	$1.20	$1.00

Terminal Spade, Cross Hole

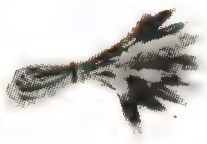


		Ea	10 Up
P 0287	Red	$1.40	$1.30
P 0289	Black	$1.40	$1.30

Multimeter Plug/Test Prods

		Ea	10 Up
P 0165	Tip Plug Red	.70	.65
P 0166	Tip Plug Black	.70	.65
P 0167	Tip Probe Red	.95	.85
P 0168	Tip Probe Black	.95	.85

Bench Test Leads



Croc Clip to Croc Clip H/Duty

P 0415 **$8.35**

Banana Plugs & Sockets

Banana Plugs

		Ea	10 Up
Solderless			
P 0268	Red	.95	.85
P 0270	Black	.95	.85
Cross Hole			
P 0274	Red	$1.40	$1.30
P 0276	Black	$1.40	$1.30
Stack Type			
P 0282	Red	$1.60	$1.50
P 0284	Black	$1.60	$1.50

Gold Plated Connectors

NEW FOR '91

Solderless type
P 0292 Banana Plug
P 0294 Spade Lugs

$9.95 pr **$9.00** 10 prs up

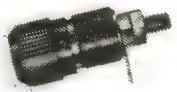
Each Pair contains 1 Red and 1 Black marked terminal.

Banana Sockets

		Ea	10 Up
P 0258	Red	.65	.60
P 0260	Black	.65	.60
Insulated			
P 0262	Red	1.35	.95
P 0264	Black	1.35	.95

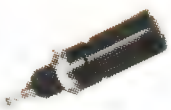
Binding Posts

With 4mm Banana Socket



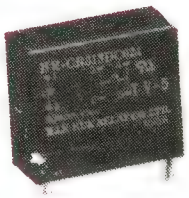
		Ea	10 Up
P 0238	Red	.80	.75
P 0240	Black	.80	.75

Captive Head Binding Posts 4mm with Crosshole



		Ea	10 Up
P 0250	Green	$1.25	$1.15
P 0252	Red	$1.25	$1.15
P 0254	Black	$1.25	$1.15
P 0256	White	$1.25	$1.15

Extra Heavy Duty PCB Relays



Low profile 25mm (H) 12V DC coil,
5A contact rating
240V AC SPDT

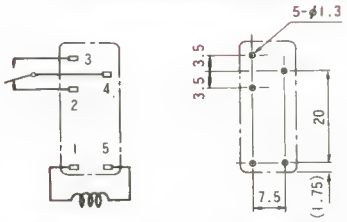
S 4170 $5.00 10 Up $4.00

Low profile 25mm (H) 24V DC coil,
5A contact rating
240V AC SPDT

S 4175 $5.00 10 Up $4.00

Low profile 25mm (H) 12V DC coil,
10A contact rating
240V AC SPDT.

S 4180 $5.50 10 up $5.10



WIRING DIAGRAM

P.C.B. LAYOUT
(copper side of board shown)

S 4170, S 4175, S 4180

Low profile 25mm (H) 6V DC coil,
5A contact rating
240V AC DPDT

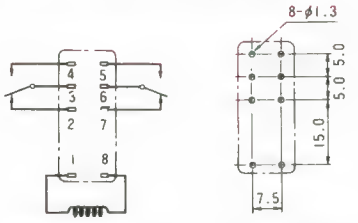
S 4185 $5.95 10 Up $5.50

Low profile 25mm (H) 12V DC Coil,
5A contact rating
240V AC, DPDT.

S 4190 $5.95 10 Up $5.50

Low profile 25mm (H) 24V DC coil,
5A contact rating
240V AC, DPDT.

S 4195 $5.95 10 Up $5.50



WIRING DIAGRAM

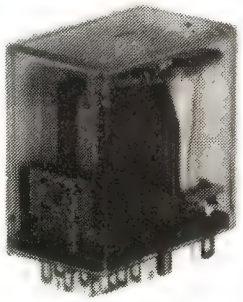
P.C.B. LAYOUT
(copper side of board shown)

S 4185, S 4190, S 4195

Cradle Relays

Pinout compatible with ITT and Siemens high sensitivity, high reliability, gold flashed contracts. Operate time 15 ms (max) release time 10 ms (max). Insulation resistance 100M. Ohm at 500V DC. Dielectric Strength 1000V AC (1 min).

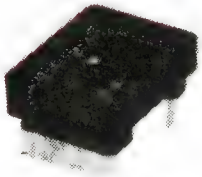
	Coil Voltage	Coil Resistance	Contact Set	Contact Current Max.	Power Max.	Price 1-24	Price 25 Up
S 4220	12	325	DPDT	2A	120VA	$ 9.60	$ 8.80
S 4225	24	1600	DPDT	2A	120VA	$ 9.60	$ 8.80
S 4230	12	170	4PDT	1A	60VA	$12.50	$11.00
S 4235	24	700	4DPT	1A	60VA	$12.50	$11.00



HUGE SAVINGS WITH OUR DIRECT IMPORT PRICE!

Cradle Relay Socket
Includes Retaining Clip

	Price	10 Up
S 4240 for DPDT Relays (S 4220/5)	$2.40	$2.20
S 4242 for 4PDT Relays (S 4230/5)	$2.40	$2.20

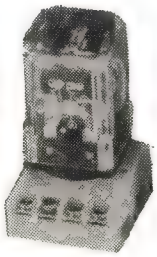


Terminal arrangement (bottom view)

Heavy Duty Relay

12V coil 10 Amp DPDT contacts. OEM quality. Heavy Duty Relay. Ideal for power supply and control circuit switch.

S 4250 $12.95 10 Up $11.50



Screw Terminal Octal Socket to Suit

Socket allows easy chassis mounting and quick cable connection to screw terminals.

S 4252 $5.95 10 Up $5.50

WIRING DIAGRAM

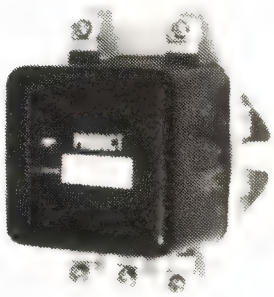
DPDT

Lamp Relay

12 - 16V coil. Two separate make contact sets 30 Amp capacity each.

S 4335 $13.50

10 Up $12.25

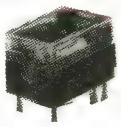


PHONEORDER TOLL FREE 008 999 007

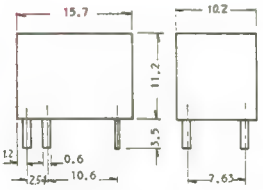
PCB Relays

Micro PCB Relay

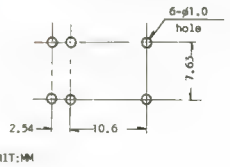
11.2 H x 15.7 W x 10.2 D
SPDT 12V DC Bobbin
1A contact rating
S 4140 $2.50
10 Up $2.25



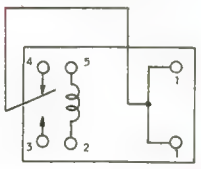
OUTLINE DIMENSION



P. C. BOARD DIAGRAM



WIRING DIAGRAMS
(Botton View)

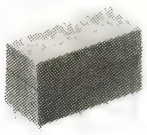


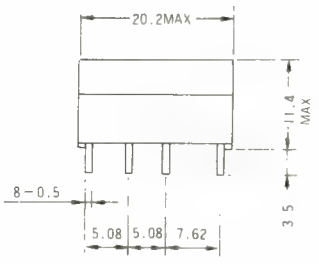
Industry Standard Double Pole, Double Throw Micro PCB Relay.

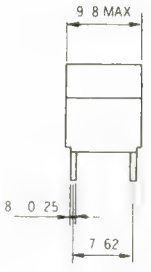
Pinout compatible with Seimens, NEC, Fujitsu.
High grade sealed construction

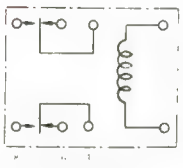
11 H x 20.3 W x 10 D
DPDT 1A contact rating
S 4150 12V DC Coil
S 4152 24V DC Coil

All $4.95 ea 10 Up $4.65

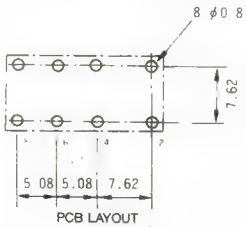






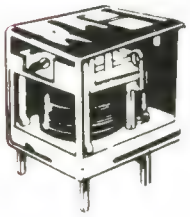


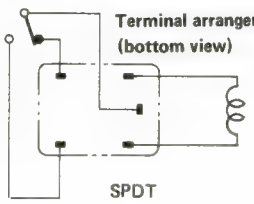
WIRING DIAGRAM

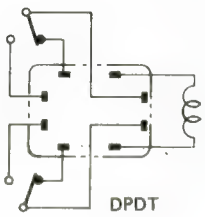


PCB LAYOUT
(copper side of board shown)

Economy PCB Relays







Mini PCB Relays Low Profile

14 H x 20 W x 12 D
12V DC Bobbin,
3 Amp Contact rating

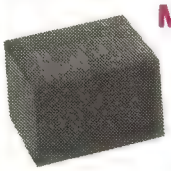
		Ea	10 Up
S 4155	SPDT	$2.50	$2.25
S 4165	DPDT	$3.95	$3.70

Mini PCB Relay H/D Low Profile 15mm (H)

12V DC Bobbin,
5 Amp contact rating

		Ea	10 Up
S 4160	SPDT	$3.15	$2.70

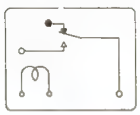
Miniature Power Relays

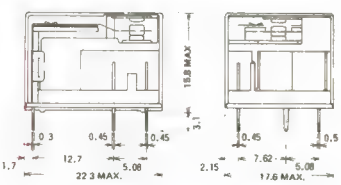


NEW FOR '91

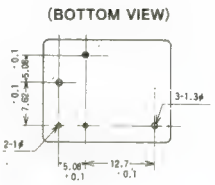
High quality. Strong sealed construction. 10A contact rating at 120V AC SPDT Telecom approved.

(BOTTOM VIEW)





(BOTTOM VIEW)



S 4202 12V Coil
S 4204 24V Coil
S 4206 48V Coil

All $4.95 10 Up $4.65

PHONEORDER TOLL FREE 008 999 007

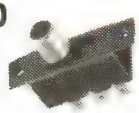
SLIDE SWITCHES

Sub-Miniature DPDT
Plastic Handle
S 2010 .45
10 Up .40

Mounting Screws
For S 2010
S 2015 Pk 100 $1.95

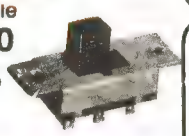
S 2016 Pk 1000 $17.50

Sub-Miniature DPDT
Aluminium Handle
S 2020 .60
10 Up .55

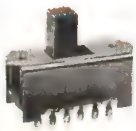


Miniature 3 Pos. 2 Pol.
Aluminium Handle
S 2030 .90
10 Up .80

Miniature DPDT
Plastic Handle
S 2035 .80
10 Up .75



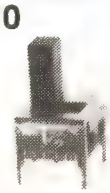
Miniature 4 Pos. 2 Pol.
Plastic Handle
S 2040 $1.10
10 Up $1.00



PCB SLIDE SWITCHES

PCB Mount DPDT
Pitch between Pins 4.25mm
Pitch between Pin rows 3mm
S 2060 .45
10 Up .40

Ultra Miniature DPDT
Pitch between pins 3mm
Pitch between pin rows 5mm
S 2063 $1.10
10 Up .95



LAMP SWITCHES

SPST 2.5A/250V
S 1075 $1.20
10 Up $1.10

DPDT 2.5A/250V
S 1076 $1.75
10 Up $1.60

REED SWITCHES

Mini Reed Switch
N/Open
S 5150 $1.30
10 Up $1.20

Mini Reed Coil
S 5151 $1.15
10 Up $1.05

MICRO SWITCHES

Micro Switch
250/3A

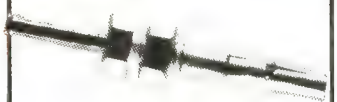
Single pole change over contacts
S 3250 $2.25
10 Up $1.95

Micro Switch With Push Button Actuator
S 3255 $5.50
10 Up $5.00

PIN SWITCHES

Make to Earth

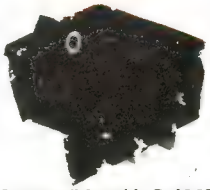
Similar to car courtesy light switches. Can be mounted under the bonnet or in the boot to operate when opened etc. 10 Amp Rating.



52mm L S 5145 .99
10 Up .90
65mm L S 5147 $1.10
10 Up .99

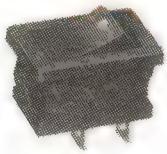
ROCKER SWITCHES

Standard Rocker Switch With Indicator Dot



Compatible with S 4007
Neon Indicator
250V 6A DPST Panel cut-out 19mm x 22mm
S 3230 $2.75
10 Up $2.50

Miniature Rocker Switch With Indicator Dot



Compatible with S 4005
Neon Indicator
Low cost snap action rocker switch - ideal as mains switch etc. 250V 6A rating. Panel cut-out required 19 x 13mm.

SPST
S 3210 $1.80
10 Up $1.65

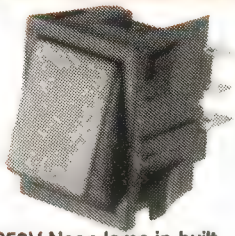
SPDT
S 3215 $2.20
10 Up $1.95

Illuminated Rocker Switch SPST 250V/6A

Panel Cutout 18.6 x 13mm

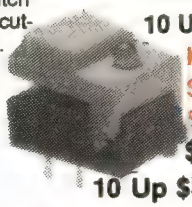
S 3217 Solder tag connections
$3.55 10 Up $3.15
S 3218 Solder pin connections
$2.45 10 Up $1.95

Mc Murdo Rocker Switch DPDT Illuminated Red



250V Neon lamp in-built.
Contact rating 250V AC 15A
Panel cutout 27 x 22mm
Positive "snap in" mounting.
S 3240 $5.50
10 Up $4.95

Keyboard Type Switches



S 1115 with LED
$3.45
10 Up $3.00

S 1110 without LED
$2.95 10 Up $2.50

High Grade Toggle & Pushbutton Switches

Standard Solder Tail Type

	EA	10 Up
S 1210 SPDT	$2.95	$2.70
S 1230 SPDT Centre Off	$2.95	$2.70
S 1240 SPDT Ctr. Off Mom+Loc	$3.50	$3.25
S 1245 DPDT	$3.10	$2.85
S 1265 DPDT Centre Off	$2.95	$2.75
S 1275 DPDT Ctr.Off Mom+Loc	$3.90	$3.60
S 1285 4PDT	$6.95	$6.20
S 1290 4PDT Centre Off	$6.95	$6.50

Straight Terminal PCB Mount Type

S 1215 SPDT	$2.95	$2.70
S 1250 DPDT	$3.95	$3.70

Right Angle Terminal PCB Mount Type

S 1220 SPDT	$2.95	$2.75
S 1235 SPDT Centre Off	$4.25	$3.90
S 1242 SPDT Ctr.Off Mom+Loc	$4.75	$4.35
S 1255 DPDT	$3.95	$3.70
S 1270 DPDT Centre Off	$2.95	$2.75
S 1280 DPDT Ctr. Off Mom+Loc	$5.25	$4.80

Horizontal Lever Action Type Switch

S 1225 SPDT	$3.75	$3.50
S 1260 DPDT	$4.95	$4.55

PHONEORDER TOLL FREE 008 999 007

TOGGLE SWITCHES

Economy Mini Toggle
Sturdy - Reliable

250V 3A

		10 Up
S 1010 SPDT	$1.90	$1.70
S 1020 DPDT	$2.50	$2.25

Standard Toggle
Sturdy - Reliable

125V/3A

		10 Up
S 1040 SPST	$1.75	$1.50
S 1050 DPDT	$2.30	$2.10

15 Amp Toggle Switch
250V 15A SPDT

S 1057 — 10 Up $2.70 $2.50

Heavy Duty Toggle
DPDT Centre Off
125V/10A (250V AC/5A)

Ideal for car antenna switch, automotive and marine electrical use.

S 1055 $3.55 10 Up $2.95

PUSHBUTTON SWITCHES

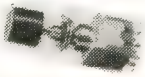
Miniature Push Button

6mm Mounting Hole
125V/3A Rating
Push to Make Contact
S 1060 .85 10 Up .75
Push to Break Contact
S 1070 $1.00 10 Up .95

Momentary Push Model
250V/3A SPST
12.5mm Mounting Hole

		EA	10 Up
S 1080	Red	$1.95	$1.75
S 1081	Black	$1.95	$1.75
S 1090	ALT ACT	$1.80	$1.60

Double Pole Push Button
Two Models 250V/1.5A Rating



DPDT Alternate Action
S 1091 $4.95 10 Up $4.50

DPDT Momentary Action
S 1092 $5.95 10 Up $5.45

Mercury Switch
Glass Encapsulated

125V/3 Amp AC
S 3070 $1.80
10 Up $1.60

Rotary Wafer Switches

6.3mm (1/4") by 32mm plain shafts. OEM Quality

	Pos.	Pole
S 3002	2	6
S 3003	3	4
S 3004	4	3
S 3005	5	2
S 3006	6	2
S 3012	12	1

All $2.65 10 Up $2.40

Sealed PCB Mount Rotary Switches

Suitable for Soldertail or PCB Connection

These quality switches are enclosed to keep the switch contacts free from airborne contaminants. The contact points are silver plated for low contact resistance and the connection points finish in PCB style pins to allow direct insertion into circuit boards or normal hardwiring as desired. A real plus feature is the ability to set the number of stops to suit your own distinct requirements e.g. A 1 Pole 9 position is easily implemented using our S 3021.

All $3.45 10 Up $2.95

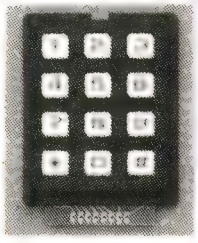
S 3021 ..... 1 Pole
Configure from 1 pole 2 position through to 1 pole 12 position.

S 3022 ..... 2 Pole
From 2 pole 2 position to 2 pole 6 position.

S 3024 ..... 4 Pole
From 4 pole 2 position to 4 pole 3 position.

S 3025 ..... 3 Pole
From 3 pole 2 position to 3 pole 4 position

Telephone or Security Keyboard Switch Matrix Type

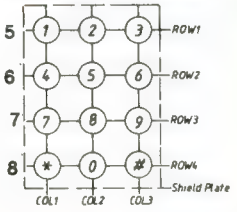


Specifications:
Contact Conductive rubber.
Rating DC 24V 5mA
Contact Resistance w200 Ohms Max.
Withstand Voltage 250V AC
Bounce 5m sec. max.

S 5380 $7.45

10 Up $7.15

CIRCUIT DIAGRAM



Pins 4 3 2 NC Pin

Snap Action Switches

PCB Mount, Super handy for custom keyboards, switches etc.

Ultra Long Life Design
Choose from 6 Colours

S 1094	Grey
S 1095	Red
S 1096	Black
S 1097	Yellow
S 1098	Green
S 1099	White

All .85 10 Up .80

Membrance Switches

PCB mount SPST

NEW FOR '91

	Ea	10 up
S 1120 6mm	.55	.50
S 1125 12mm	.75	.70

PCB Mount Push Buttons

NEW FOR '91

DPDT Alt. Action

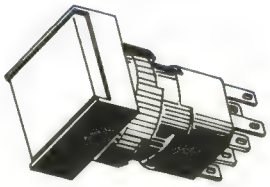
		10 up
S 1410 Single	$.75	$.70
S 1430 Bank of 6	$6.95	$6.45

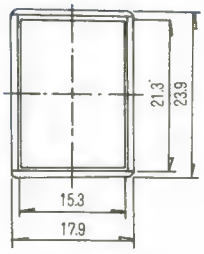
Knobs to suit	H 6630 Black
H 6610 White	H 6630 Red
H 6620 Grey	All .35 10 up .30

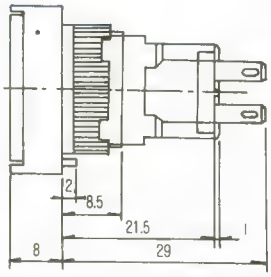
PHONEORDER TOLL FREE 008 999 007

Professional Switches For Industry
All Listed By Underwriters Laboratory USA

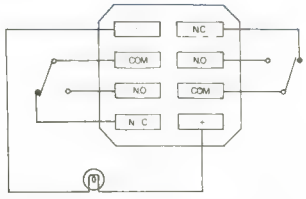
Illuminated push button switches and displays







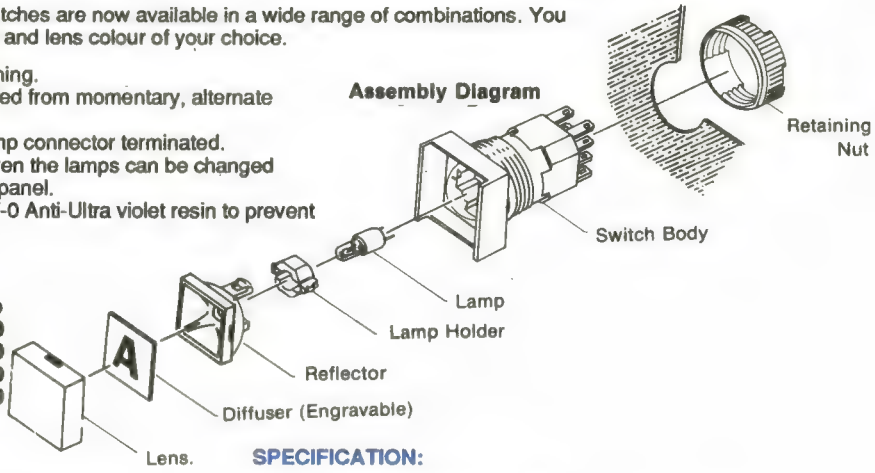
Pinout (when viewed from rear)



These professional quality illuminated Switches are now available in a wide range of combinations. You simply select the body style, lamp voltage and lens colour of your choice.

- Snap action ensures soft touch switching.
- Any desired action type can be selected from momentary, alternate action and display only types.
- Switch terminals can be solder or crimp connector terminated.
- No tools required for maintenance, even the lamps can be changed without removing the switch from the panel.
- The lenses are moulded from UL 94V-0 Anti-Ultra violet resin to prevent colour fading.

Assembly Diagram



Momentary Switches

			10 Up
S 1510	Red Lens	$16.00	$15.00
S 1512	Green Lens	$16.00	$15.00
S 1514	Yellow Lens	$16.00	$15.00
S 1516	White Lens	$16.00	$15.00

Alternate On/Off Switches

S 1530	Red Lens	$16.00	$15.00
S 1532	Green Lens	$16.00	$15.00
S 1534	Yellow Lens	$16.00	$15.00
S 1536	White Lens	$16.00	$15.00

Illuminated Display Only

S 1550	Red Lens	$7.95	$7.25
S 1552	Green Lens	$7.95	$7.25
S 1554	Yellow Lens	$7.95	$7.25
S 1556	White Lens	$7.95	$7.25

Lamps

S 1580	12V Lamp	$2.50	$2.25
S 1585	24V Lamp	$2.50	$2.25

Safety Cover

S 1595	Safety Cover	$3.95	$3.50

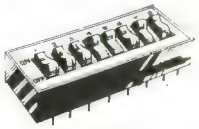
SPECIFICATION:

Rated Current/Voltage 3A/250V AC
Insulation Resistance 100M Ohm/500V DC
Dielectric Strength
Between Switch Terminal AC 1,000V 1 Min
Between Switch Terminal and Lamp Terminal AC 1,500V 1 Min
Operating Force 300 - 350g
Stroke 3mm
Service Life
Electrical 3A/250V AC 50,000 operations Min
1A/250V AC 100,000 operations Min
Mechanical Momentary 1,000,000 operations Min
Alternate 100,000 operations Min.

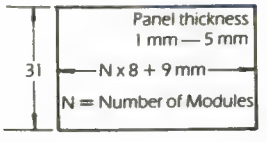
Dil Switches

Gold Plate Self Wiping Contacts

		EA	10 Up
S 3045	2 Way	$1.95	$1.75
S 3050	4 Way	$2.15	$2.00
S 3055	6 Way	$2.25	$2.05
S 3060	8 Way	$2.50	$2.25
S 3065	10 Way	$3.25	$2.95



BCD 0-9
Thumbwheel Switch



Panel mount BCD coded units that simply slot together to produce switches of your required size. Each unit is engraved 0-9 (white on black). Output is coded in BCD with 8-4-2-1 weighting. Body and wheel made of Duracon resin. PCB's are gold plated copper on epoxy fibreglass. Continuous load 1A max. Panel cutout for one unit 16mm x 30mm. Allow further 8mm per extra unit.

S 3300 $6.95 10 Up $6.50

S 3305 End Caps/pr $1.75 10 Up $1.60

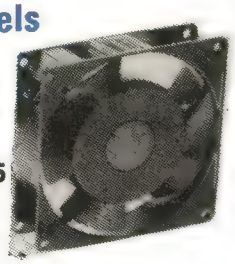
PHONEORDER TOLL FREE 008 999 007

HI-SPECIFICATION COMPUTER FANS

Durable die cast aluminium venturi PBT plastic impeller of 94V-0 material. Shaded pole motor with ball bearings.

240V 50Hz Models

80mm, 30 CFM Air Flow



Input Power 16W **Speed** 2300RPM
Noise Level 31dbA

F 1020 $32.95 10 Up $30.95

80mm x 80mm x 32mm

120mm, 80 CFM Air Flow

Input Power 25W **Speed** 2600RPM
Noise Level 43dbA

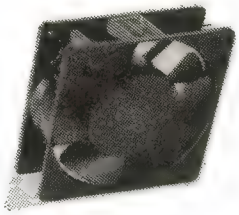
F 1030 $32.95

FANTASTIC VALUE

10 Up $30.95

120mm x 120mm x 38mm

24V DC Brushless Fan

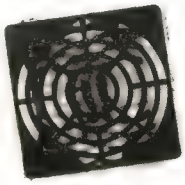


Electronically commutated DC motor
Current 330mA **Speed** 3100RPM
Noise Level 32dbA, **Air flow** 23 CFM

F 1040 $29.95

10 Up $28.00

120mm x 120mm x 38mm



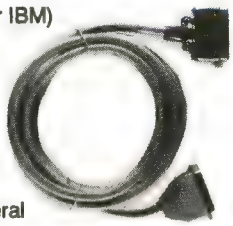
Fan Finger Guards

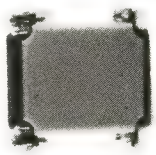
F 1022 for 80mm Fan
F 1032 for 120mm Fan

$2.45 each
$2.25 10 Up

D25 LEADS AND ADAPTORS

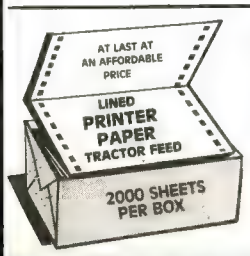
P 0758	D25 Male to Centronics (Use for IBM) 1.8M	$19.95
P 0759	D25 Male to Centronics (Use for IBM) 3.6M	$24.50
P 0762	D25 Male to D25 Male Lead 1.8M	$19.95
P 0764	D25 Male to D25 Female Lead 1.8M	$19.95
P 0761	D25 Male to Female D9 Peripheral 30cm	$6.95





D25 Female to D25 Female Gender Changer

P 0760 **$17.95**



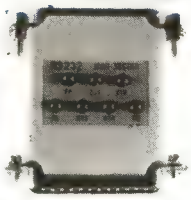
Altronics Printer Paper

Faintly ruled one side and pure white the other.
Box of 2000 sheets

D 1160 240mm Width $59.95

D 1165 380mm Width $76.00

RS 232 ACCESSORIES



RS-232 Mini Tester

This tester indicates the presence of all important interface lines by LED illumination when signal is active. All 25 pins are connected straight through.

D 1500 $22.50

RS-232 Jumper Box

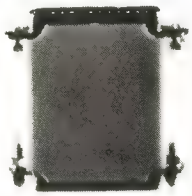
Used to make custom RS-232 interfaces. By custom wiring, many different interfaces can be built: null modems, pin reversers, etc.

D 1520 $9.95

RS-232 Surge Protector

Uses Metal-Oxide Varistors to protect pins 2,3 and 7. One male & one female connector with all 25 pins connected straight through. MOV's connected between pins 1 and 2 and pins 1 & 7. The MOV's suppress any voltage above 26 volts without affecting the normal RS-232 voltage levels. The MOV's are capable of handling one joule of energy & 250 amps peak current.

D 1510 $19.50



Null Modem

Use when Transmit DATA and Receive DATA need to be reversed.

D 1530 $6.95

In-line RS-232 Break Out Box

NEW IN '91

Designed for circuit testing, mounting and patching. It has ten signal powered LED's as well as two spares to indicate which lines are in use at any one time. It also has 24 switches as well as jumper leads to allow you to break out circuits or reconfigure and patch all of the 24 active lines.

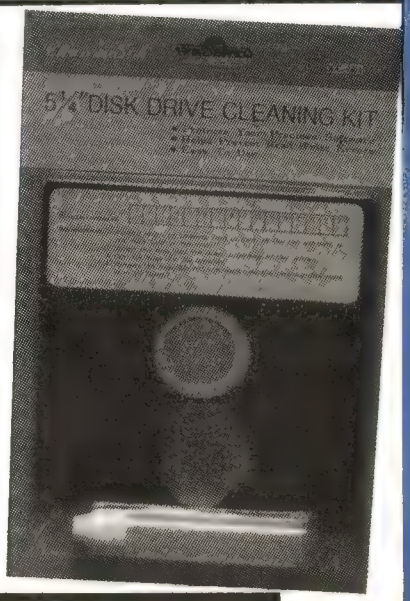
D 1540 $99.95

Disk Cleaners

Now-a-day's computer hardware and software doesn't come cheap, and is often difficult to replace. So protect your valued investments with our 5¼" floppy disc cleaners.

D 1807 3½" Kit
D 1809 5¼" Kit

NEW FOR '91



$5.95

DIRECT IMPORT PRICE

COMPUTER ACCESSORIES

PHONEORDER TOLL FREE 008 999 007

WIRE/CABLES

Pro Grade Hook-up wire. All on 100m reels.

Light Duty Hookup Tinned 7/.16mm

W 0250	Red	W 0254	Yel
W 0251	Blk.	W 0255	Grn
W 0252	Brn	W 0256	Blu
W 0253	Orn	W 0257	Wht

Per metre .18

Per 100m Reel $9.50

Buy Eight Reels for Only $65

Medium Duty Tinned 14/.20mm

W 0260	Red	W 0261	Blk
W 0265	Blu	W 0268	Wht

Per metre .25

Per 100m Reel $18.00

Buy Four Reels for Only $60

Heavy Duty 24/.20mm

W 0270	Red	W 0272	Blk
W 0274	Green		

Per metre .29

Per 100m Reel $22.00

Buy Three Reels for Only $55

Extra Heavy Duty 32/.20mm

W 0280	Brown	W 0282	Blue

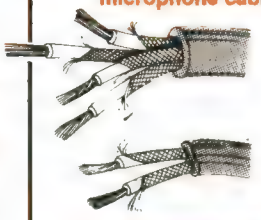
Per metre .38

Per 100m Reel $25.00

Buy Two Reels for Only $40

SHIELDED AUDIO CABLES

Supplied on 100m reels (not Hanks). Eminently suitable for microphone cable, chassis wiring, building wiring.



	Per m	Per Reel
W 1010 1 Core	.50	$32.00
W 1020 2 Core	.70	$55.00
W 1022 2 Core '8'	.75	$57.00
W 1040 4 Core	1.25	$90.00

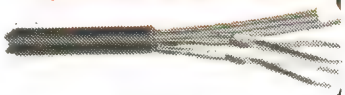
Extra Heavy Twin Mic Cable

20 x .12mm by 2
Suit Entertainment Work

W 1030 $2.20 per m

$150 per 100m Roll.

Special Audio/Data Cable



2 x 2 pairs. Individually shielded and Drain Wire.

W 1032 $1.95 per m

$150 per 100m Roll.

100% Screened Computer Cable

7/.2mm Tinned Alum. Mylar Shield

	Per m
W 0705 4 Wire	$1.40
10 Up	$1.15
W 0710 6 Wire	$1.80
10 Up	$1.50
W 0715 9 Wire	$2.30
10 Up	$1.99

4 Core Security

Quality 14/.20 for professional security/alarm system. Inner conductor colours yellow, green, red, blue. Three outer sheath colours available.

W 0354 Grey
W 0355 Black
W 0356 White

.80 per m

$138 per 200m Roll.

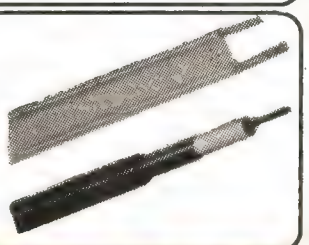
Figure '8' Cable On Reels

For speaker wiring, security systems, PA systems, low voltage wiring etc. All have polarity trace stripe.

Cat.No.	Conductor	Colour	Trace Colour	Reel Length	Per m	Per Reel
W 0100	2x14/.14	Grey	Black	100m	.35	$25.00
W 0105	2x14/.193	Grey	Black	100m	.45	$30.00
W 0110	2x19/.193	White	Red	200m	.50	$64.00
W 0112	2x19/.193	White	Black	200m	.50	$64.00
W 0114	2x19/.193	White	Green	200m	.50	$64.00
W 0116	2x19/.193	White	Blue	200m	.50	$64.00
W 0122	2x24/.20	Red/Blk	-	200m	.63	$88.00
W 0124	2x24/.20	White	Red	500m	.63	$220.00
W 0125	2x24/.20	White	Black	500m	.63	$220.00
W 0126	2x24/.20	White	Green	500M	.63	$220.00
W 0127	2x24/.20	White	Blue	500M	.63	$220.00

Feeder and Coax Cables

		Per m.	10Up
W 0220	300 Ohm Clear Ribbon	.30	.23
W 0221	300 Ohm Black Ribbon	.35	.39
W 0222	75 Ohm Coax (STD)	.80	.69
W 0224	75 Ohm Coax Low Loss	1.05	.93
W 0226	RG 58AU 52 Ohm Coax	.80	.69
W 0230	RG62 92 Ohm Coax	1.50	1.20



Instrumentation Cable 510 Strand

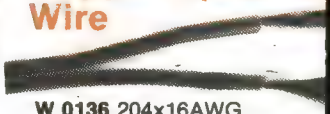
Cable overall diameter 3mm. Super flexible - Super durable.

W 0540 Red $2.95 per m

W 0542 Blk $2.95 per m

$50 per 20m Roll.

Oxygen-Free Copper Speaker Wire



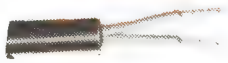
W 0136 204x16AWG
$3.95 per metre
$29.95 per 16m roll

W 0138 504x12AWG
$4.95 per metre
$55.00 per 16m roll

Whopper Super Low Loss Speaker Cable

W 0130 2x90.18mm
Per metre $2.95
10m $2.50

Double Insulated Twin



W 0190 2 x .75mm
Per metre $1.20
10m .99

Mains Cable

3 Core, 7.5 Amp 250V

W 0570 $2.10 per metre

$1.90 10m+

Telephone Type Cable

	Per m	/200m roll
W 0302 2 pair	.60	$79.00
W 0303 3 pair	.80	$100
W 0306 6 pair	$1.50	$240
W 0310 10 pair	$2.40	$330

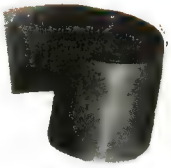
Flat Modular Telephone Cable

As used on most modern phones. Suits our range of crimp style modular plugs. (See page 51).

	Per m	100m roll
W 0312 4 core	.59	$55.00
W 0313 6 core	.79	$75.00
W 0314 8 core	.95	$95.00

IDC Cable

		Perm	10 Up
W 0610	10 Way	$1.50	$1.30
W 0616	16 Way	$1.75	$1.60
W 0626	26 Way	$2.95	$2.45
W 0634	34 Way	$3.25	$2.90
W 0650	50 Way	$4.95	$4.50



Rainbow Cable

1.27mm Pitch

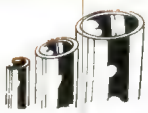
		Per m	10 Up
W 0510	10 Core	$2.25	$2.05
W 0516	16 Core	$3.95	$3.50
W 0524	24 Core	$5.50	$5.05

Enamelled Winding Wire

Handy hobby packs - for coil winding etc.

	Metric	B + S	Pack	Per m	10 Up
W 0402	.2mm	32	25g	$5.95	$5.45
W 0403	.25mm	30	25g	$5.95	$5.45
W 0404	.4mm	26	25g	$5.95	$5.45
W 0405	.5mm	24	100g	$8.65	$8.15
W 0406	.63mm	22	100g	$8.65	$8.15
W 0407	.8mm	20	100g	$8.65	$8.15
W 0408	1mm	18	100g	$8.65	$8.15
W 0409	1.25mm	16	100g	$8.65	$8.15
		Tinned Copper Wire			
W 0420	.71mm	22	100g	$9.95	$9.50

Heatshrink Sleeving



By the metre		per m	10 Up
W 0561	1.6mm	$2.50	$2.25
W 0562	2.4mm	$2.95	$2.75
W 0563	4.8mm	$3.25	$2.95
W 0564	6.4mm	$3.50	$3.20
W 0565	12.7mm	$4.95	$4.50
W 0566	19mm	$6.95	$6.40

Hobby Pack

Includes: (internal diameter)
1.6mm,2.4mm,4.8mm,6.4mm 12.7mm,19mm.

W 0567 $4.95

Din and RCA Audio Leads

P 0420	5 Pin Din/5 Pin Din 1.2m (Reversed Connections for video)	$3.25
P 0421	5 Pin Din/5 Pin Din 1.2m	$4.65
P 0423	5 Pin Din/4 RCA 1.2m	$7.95
P 0427	4 RCA/4 RCA (male) 1.2m	$6.95
P 0430	5 Pin Din/2 RCA (male) 1.5m	$4.50
P 0435	2 RCA/2 RCA (male) 1.2m	$3.45

Video & Test Leads

1.8 metre

P 0740	PL259/PL259		$5.50
P 0742	PL259/BNC	male	$7.50
P 0744	PL259/RCA	male	$4.75
P 0746	BNC/BNC	male/male	$7.95
P 0748	BNC/RCA	male/male	$6.45
P 0750	RCA/RCA	male/male	$5.95
P 0752	BNC/Croc	Clips male	$8.55

TV Antenna Fly Leads

1.8m Long

P 0755	Male/Male	$3.70
P 0757	Male/Female	$3.70

High Quality Oxygen Free Copper Audio Leads

All Plugs and Connectors Gold Plated

NEW FOR '91

P 0438	1 RCA/1 RCA 1.8m	$9.50
P 0440	2 RCA/2 RCA 450mm	$11.00
P 0442	2 RCA/2 RCA 900mm	$12.00
P 0444	2 RCA/2 RCA 1.8m	$13.50
P 0446	2 RCA & Earth Lug each end 900mm	$16.00
P 0448	2 RCA & Earth Lug each end 1.8m	$19.50

MICRON T2440 MK II

Electronic Temperature Controlled, Temperature Selectable, Soldering Station

The MICRON T 2440 soldering station offers the ultimate in controlled temperature hand soldering. 320°C, 350°C, 380°C, 410°C, 440°C (608°F ,662°F, 716°F, 770°F and 824°F) Temperature range is switch selected. There is no need to change soldering iron tip.

Specification Model T 2440

Mains power	240VAC
Heater Voltage	24VAC
Heater power consumption	48 Watts
Standard Tip	T 2428

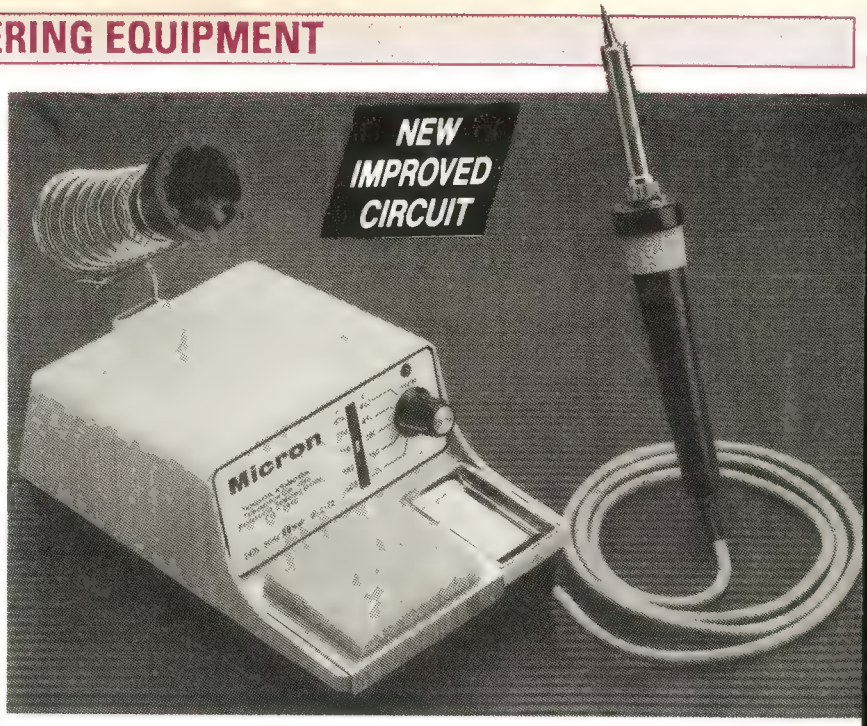
Temperature Readout via LED baragraph instantly visible.

Temperature Control. A unique electronic control circuit maintains tip temperature to within +/- 1 deg.C of idling. This is accomplished by embedding the thermocouple sensing unit in the heating element barrel. This method allows the closest possible monitoring of tip working surface temperature. This means the tip is not overheated, and so tip and heater life is greatly enhanced. It also means excellent heat recovery during heavy soldering.

Zero Voltage Switching. The revolutionary electronic "Zero Voltage" switching, protects voltage and current sensitive devices such as CMOS against transient voltage spikes.

Grounded Tip. The soldering tip is grounded through the power unit to ensure the tip leakage is less than 0.4 mV to 0.03 microampere.

Low Voltage Element. 24V element for added safety especially with CMOS and microprocessor soldering situations. Silicon rubber iron lead used providing a comfortable, flexible connection to station and durability against accidental burn damage.



Chrome Plated Iron Clad Tip. Regardless of the excellence of the station and iron element, it is absolutely imperative the iron tips be of a high standard, easily cleaned and long life. The Micron tips are "State-of-the-Art" chrome plated, iron clad ultra long life, very resistive to over heating, clean easily and what's more are very reasonably priced! Developed to meet the present and future needs of the electronic production industry, service technician and hobbyist.

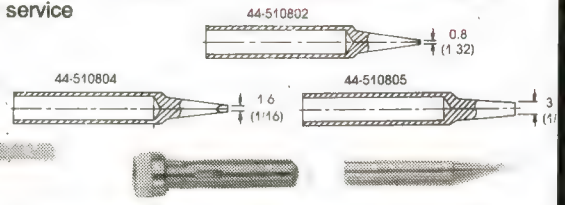
T 2440 $159.95

When ordering replacement tips for soldering stations purchased prior to 1990, please order as follows: all $5.50 each.

MICRO CHISEL	MINI CHISEL	STD CHISEL
T 2423 1mm	T 2424 1.5mm	T 2425 3mm

MK II Replacement tips $5.50 ea

MICRO CHISEL	MINI CHISEL	STD CHISEL
T 2427	T 2428	T 2429
0.8mm	1.6mm	3.2mm



NEW! From Jan 1990 the MICRON T2440 MK II will have a new CERAMIC CARTRIDGE and the replacement tips will not be compatible with the earlier soldering station. Therefore we will offer BOTH TYPES at the OLD PRICE!

Temperature Adjustable 250°C to 450°C

Excellent new iron, screwdriver temperature adjustable between 250°C and 450°C enabling very delicate soldering on low settings with surprising heat energy reserve on maximum setting. Relative temperature is indicated by LED lamp brightness. Much lower cost than a soldering station.

T 2445 $37.95

Spare tips as for T 2420 Professional temperature fixed iron.

Low Cost Micron 25 Watt Soldering Iron

Light-weight ● efficient thermal transfer from element to tip ● tip temperature maintains within the limits suitable for electronic work and also small household jobs. **Fully SEC tested and approved.**

Tip T 2416 $2.50

T 2415 $19.50

12V Soldering Iron

For the motorist. Compact soldering iron. Just plugs into car lighter socket.

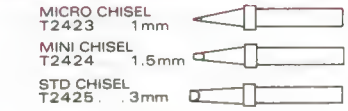
T 2512 $12.95

Professional Temperature Fixed Soldering Iron Comes supplied with T 2424 tip

● 370 deg. Fixed Temperature ● High efficiency patented heating element ● Iron clad, chrome plated, long life interchangeable tips. This iron uses high grade iron clad, chrome plated and pretinned tips. Tip life expectancy is many times that of conventional plated tips.

T 2420 $27.50

Soldering Iron Replacement Tips



Tip	For Model	Price
T 2416	T 2415	$2.50
T 2423	T 2420/T 2445	$5.50
T 2424	T 2420/T 2445	$5.50
T 2425	T 2420/T 2445	$5.50

PHONEORDER TOLL FREE 008 999 007

Fully Portable Multi-Purpose Gas Soldering Kit

Great when you're working on the boat, car, farm, TV antenna or anywhere in the field.

Features:

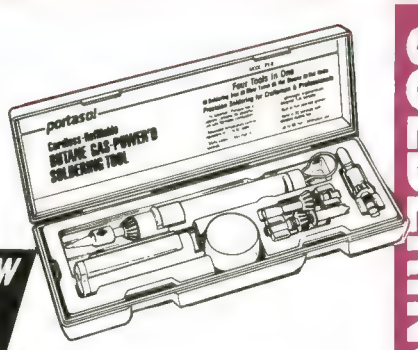
- Kit includes hot blower head, hot knife head, polyfoam cutter tip, burner tip.
- No cords, batteries or gas bottles
- Heavy duty tip temperature up to 400°C
- Powered by standard butane gas lighter fuel.
- Up to 60 minutes continuous use. Refills in seconds.
- Adjustable temperature equivalent to 10-60 Watts.
- No leakage currents to sensitive circuits.

T 2470 $79.00

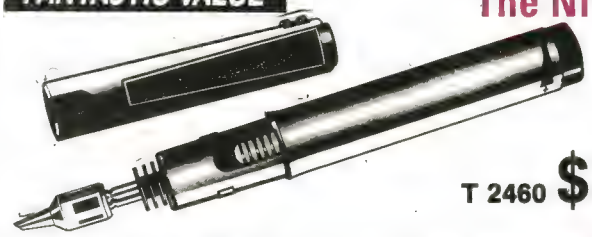
Spare tips $13.95 ea

T 2471 1.0mm
T 2472 2.4mm
T 2473 3.2mm
T 2474 4.8mm
T 2476 Blow torch
T 2477 Hot air blower

NEW IN '91



FANTASTIC VALUE



The Nifty Go-Anywhere Butane Soldering Iron

with the same great features as the T 2475 Gas Iron

T 2460 $39.95

Spare tips with catalytic heater

T 2463 1.0mm
T 2464 2.4mm
T 2465 3.2mm
T 2466 4.8mm

$12.95ea

Hi Speed One Shot Desoldering Tool

EXCLUSIVE TO ALTRONICS IN AUSTRALIA THIS U.S. DESIGNED TOOL IS THE ROLLS ROYCE OF HANDHELD PORTABLE DESOLDERING TOOLS

A UNIQUE CONCEPT IN DESOLDERING

- No Stations
- No Compressed Air
- No Vacuum Lines

NEW IN '91

EXCLUSIVE TO ALTRONICS

FEATURES:

- **Totally Self Contained**
- **Light & Compact**
- **Ergonomically Designed**
- **Zero Static Tip**
- **Interchangeable Standard Tips**
- **Highest Quality Materials**

• Completely Portable

The ONE-SHOT desoldering tool is a totally self contained unit; all it needs is a standard 240 volts, AC, electrical outlet.

• Efficient Design — Perfect Working Angle

The ONE-SHOT incorporates the ultimate design for working comfort: perfect balance, ideal working angle, such that the work (P.C. board, etc.) lies flat on the table top.

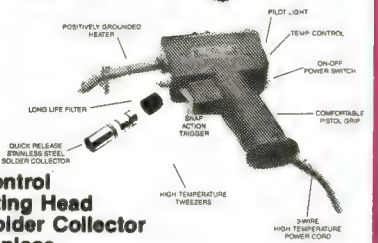
• Easy to Clean

The ONE-SHOT generates a high-speed, "one-shot" vacuum wave every time the trigger is squeezed. This fast action vacuum causes the molten solder to flow immediately into the collector tube, thru the shortest possible path, where the solder is solidified into small particles. The unique solder collector assembly allows the removal of the collector by simply pushing it back and out. Inside is the specially designed filter which not only stops solder, but fumes and powdered debris. The entire cleaning operation takes a few seconds, and it is done while the tool is hot.

T 1260 Desoldering Tool **$299.00**

T 1269 Bench stand to suit **$29.95**

FANTASTIC VALUE



- **Long Life, Low Cost Filter**
- **Electronic Temperature Control**
- **Long Life, Extra Hard Heating Head**
- **Quick Release Stainless Solder Collector**
- **No Seals or Washers to Replace**
- **Power On/Off Switch**
- **Heater Power Consumption: 60 watts**

• Light Weight

The ONE-SHOT weighs only 1.3Lb. (590g), including cord.

• High Quality Materials

This superb tool utilizes the highest quality materials: i.e. all internal plastic parts, including the tweezers, are made from super tough, high temperature Hytrell*, and the case, trigger, and nose piece are made from high strength, high temperature, glass filled Valos**.

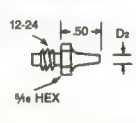
• Interchangeable Tips

A variety of standard tips with stainless steel inserts is available, off the shelf, including our new long-life, self cleaning tips.

Replacement Tips

T 1262 .8mm Hole **$9.95**
T 1264 1.0mm Hole **$9.95**
T 1266 1.2mm Hole **$9.95**

AVAILABLE TIP SIZE CHART

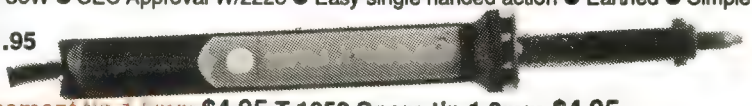


PART NO.	Din (mm)	Drin (mm)
XL-08	.031 (0.8)	.071 (1.8)
XL-10	.040 (1.0)	.090 (2.3)
XL-12	.047 (1.2)	.105 (2.7)

Multiple De-Soldering Tool

Ideal for the service technician and hobbyist alike. This lightweight de-soldering iron allows components to be quickly and cleanly removed with one hand. Naturally it's SEC approved and comes with a cleaning wand. **Can be used as a soldering iron.**
● 240V AC 50Hz 30W ● SEC Approval W/2228 ● Easy single handed action ● Earthed ● Simple cleaning action.

T 1250 **$59.95**



Please see SOLDERING TOOLS & AIDS, pages 94 & 95 for our full range of soldering equipment.

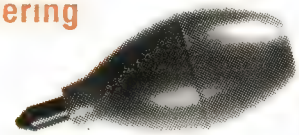
T 1255 Replacement tip 1.5mm **$4.95** T 1252 **Spare tip 1.2mm $4.95**

Solder Suckers (Professional Quality)

Self cleaning plunger. Long life Teflon Tip. Double diaphragm. **Dual O-Ring seal.** 225mm x 20mm (d) 50mm stroke powerful suction.

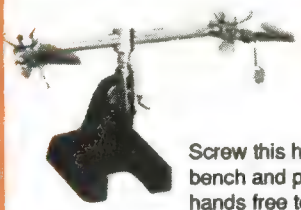
T 1240 **$11.95** Replacement tip T 1241 **$2.35**

Desoldering Bulb



The simple way to remove solder. Just heat up the joint, hold the nozzle near the molten solder, squeeze....that's all!

T 1245 **$4.95**

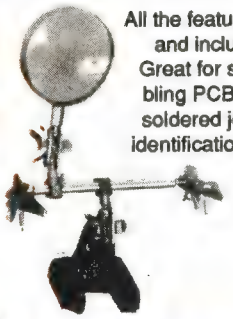


PCB Stand With Alligator Clips

Screw this handy little jig to your work bench and presto! you now have both hands free to insert and solder components!!

T 1450 **$9.50**

PCB Stand With Magnifier



All the features of the T 1450 and including a magnifier. Great for servicing, assembling PCB's and inspecting soldered joints, component identification, cracks in PCB tracks etc.

T 1460 **$14.95**

Solder

200g reel 1mm gauge. Suitable for most electronic jobs. Resin cored includes bit saving additive.

T 1200 200g roll **$7.00**
T 1205 5m roll **$1.95**

Desk Mounted Magnifier Lamp

This unit magnifies any object under a clear, cool, fluorescent light. The magnification is the maximum obtainable (lens 127mm diameter biconvex 4 dioptres focal length 254 mm) consistent with minimum distortion and eyestrain and good off-angle parking.

A 0980 **$279.00**

Soldering Iron Stand

Heavy Iron Base
T 1310 **$12.95**
Spare Sponge
T 1320 **$1.95**

SERVICE ITEMS

Electro-Mechanical Lubricant

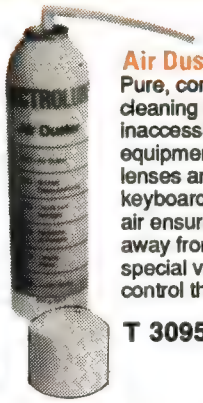
A non-conductive lubricant. Use to ensure smooth operation of moving electrical parts.
NO MORE SCRATCHY POTS OR STICKY RELAYS.

T 3045 **$16.95**

Permagard

This is a modern multi-purpose maintenance fluid which will dispel moisture, penetrate, lubricate and protect from rust and corrosion. It can be used to dry out damp electrical connections, penetrate corroded nuts, bolts and locks, to lubricate and protect metal surfaces such as garden tools, electrical tools, locks, bikes etc. 200g

T 3040 **$11.95**

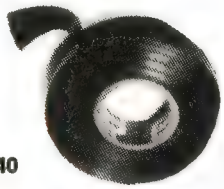


Air Duster

Pure, compressed inert gas for cleaning very delicate or inaccessible areas of computer equipment, photographic lenses and equipment, keyboards etc. The direct jet of air ensures dust is transferred away from the equipment. A special valve allows you to control the flow of air. 400g.

T 3095 **$29.95**

PVC Tape



Quality Tape. Heat resistant 20m x 19mm

T 3001 **$1.40**

Silastic Compound

150g pack Adhesive/Sealant provides tough non-brittle seal or joint. Corning 762RTV

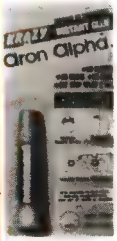
T 3015 **$7.50**

Desoldering Braid

The most efficient way to de-solder. Just place the specially treated braiding over the joint, apply the soldering iron & the braid will soak up the solder.

T 1215 1.5mm Yellow
T 1220 2.0mm Green
T 1225 2.5mm Blue

All $2.00 ea



Instant Super Type Glue

Dispenser carry tube dispenses only when tube body is depressed ensuring no leaks. Many times the number of bonds over conventional tubes. **Sticks in seconds - 1000's of uses**

T 3010 **$2.95**

Five Minute Epoxy

Similar to "Araldite" this multipurpose super strong epoxy in handy dual syringe.

T 3005 **$8.50**

ELECTROLUBE SERVICE AIDS

PROTECTION OF OUR OZONE LAYER

There has been much discussion recently on CFC's & how they destroy the ozone layers. During 1989, CFC propellants in Electrolube products have been replaced with Propellant 22 (difluorochloromethane). Propellant 22 has the same excellent propelling qualities as CFC's including non-flammability, but **without** their harmful effects. Why has 22 not been used before? Because CFC's were cheaper. Only a worldwide company like Electrolube could utilise this excellent propellant to provide industry with a complete working range of cleaners, coatings, lubricants & service aids. Yes, Electrolube "H" range is a little more expensive because of Propellant 22, but not as high as the price of our ozone layer. The new propellant cans have a green tree and statement on the cap for identification. The high standards of industry & electronics need this propellant. Thank you Electrolube.

Electro-Mechanical Lubricant

Identical electrical and mechanical properties to the Electro-Mechanical Lubricant aerosol, but supplied in a self-sealing nylon pen, with retractable snorkel tube, for pin point application.

T 3062 $8.95

Silicone Compound Aerosol

A multi-purpose compound with exceptional water and moisture-repelling characteristics. Contains no solvents - formulated from silicone compound and propellants for continuous application to the required thickness. Deposits a tenacious, grease-like coating to seal electrical and electronic equipment from the ingress of moisture and atmospheric pollution. Excellent resistance to tracking and corona discharge. Resists extremes of temperature (-50 deg.C to +200 deg.C), insulates and protects metals, rubbers and plastics. Non toxic, non-flammable and odourless.

T 3050 $18.95

Anti-Static Foam Cleanser

A very efficient foaming cleanser for hard surfaces, especially those prone to static dust attraction. Specially developed for use on plastics, metals, glass and synthetic surfaces. Removes existing static charges and prevents further build-up for extended periods. *Not suitable for records, where only Electrolube Anti-Static Record Cleaner should be used.

T 3055 $8.95

Contact Treatment Oil 170g Aerosol

An extra high-quality contact treatment oil for the most critical applications, when long-term performance and reliability are vital. Particularly suitable for new contact surfaces which are free of dust or tarnish and require the highest operational advantage. Anti-static, safe on most plastics, paints and rubbers.

T 3060 $17.95

Clear Protective Lacquer

A flexible coating for protecting printed circuit boards components and surfaces from humidity and other forms of environmental attack, and for E.H.T. sealing. Electrolube Clear Protective Lacquer will not discolour or crack and is easy to solder-through, for modifications or repairs. The convenient aerosol pack eliminates the need to use expensive spray equipment involving laborious cleaning operations and viscosity checks. Electrolube Clear Protective Lacquer conforms to most International Specifications.

T 3085 $13.95

Electronic Cleaning Solvent

A fast-drying, safety solvent for quick and efficient cleaning of electrical contacts, electronic components, tape heads, video equipment, computers and all delicate surfaces.Non-flammable, extremely low in toxicity, safe to use during equipment operation, and harmless to plastics, rubbers and elastomers. After cleaning electrical contact surfaces, apply an Electrolube Contact Treatment.

T 3065 $11.95

Freezer

A safe, time-saving method for detecting dry joints and overheating components. Unique Electrolube formula contains a minute proportion of a special fluid to prevent the resultant condensation causing corrosion or reduction of insulation resistance. Other uses include preventing component damage during soldering, testing thermostats/thermosensitive components, repairing thermometer threads, and small mechanical shrink fitting. Cools to below -50 deg.C

T 3082 550g $24.95

Printed Circuit Board Cleaner

A non-flammable blend of solvents for removing contaminants from printed circuit boards and flux residues from soldering. Test small area before use on plastics.

T 3067 200g $12.95

T 3068 550g $19.95

Contact Cleaning Strips

The unique cleaning, lubricating and protecting treatment for small relay and non-wiping contacts, edge connectors and other areas where only a very thin film of Contact Treatment is required.

T 3070 $6.95

Nickel Screening Compound

An electrically conductive coating which gives extremely efficient screening against RFI and EMI. With a quick drying time at room temperature, Nickel screening compound can be used to coat computer cabinets VDU's and a variety of electronic and electrical housing of any complex shape.

T 3100 $53.95

Conformal Coating

Aerosol-A MIL-SPEC lacquer for use when equipment may be exposed to extremes of temperature and weather. **Department of Aviation approval.**

T 3090 $38.95

RP50 Positive Photoresist Aerosol

The RP50 aerosol is a fast drying positive photoresist for one to one reproduction of circuits, diagrams and images on metals from transparent positive masters. The aerosol has been introduced for small production requirements at home or in the lab. Complete instructions for use are included with the aerosol. Used in conjunction with Photo resist developer.

T 3111 200ml $36.95

Photoresist Developer

Safe Aqueous Alkali Developer for use with RP50 Photoresist. Takes 30-60 seconds at 20 deg.C

T 3115 $14.95

Ultraclene Degreasing Solvent

Non flammable, fast drying general purpose safety solvent with powerful penetrating action for heavy duty degreasing applications. Highly recommended for cold cleaning. Test small area before use on plastics.

T 3064 $11.95

SERVICE AIDS

PHONEORDER TOLL FREE 008 999 007

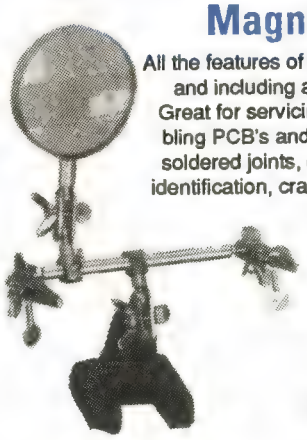
TOOLS

PCB Stand With Alligator Clips

T 1450 $9.50

Screw this handy little jig to your work bench and presto! you now have both hands free to insert and solder components!!

PCB Stand With Magnifier

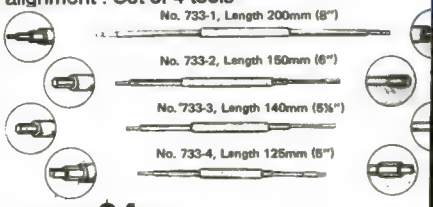


All the features of the T 1450 and including a magnifier. Great for servicing, assembling PCB's and inspecting soldered joints, component identification, cracks in PCB tracks etc.

T 1460 $14.95

Alignment Tool Set

Super tough deirin plastic. Universal alignment . Set of 4 tools



T 1400 $4.20

Alignment S/Drivers

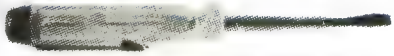
Metal Tip

T 1401 100mm Shaft $2.95
T 1402 200mm Shaft $3.95

Steel Rule 300mm

T 2382 $5.95

Neon Test Screwdriver



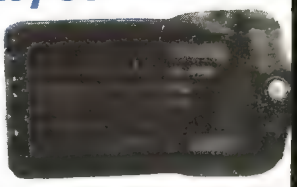
A 3mm blade screwdriver with a built-in neon. Good for power points, extension leads, fuses, etc.

T 2222 $3.85

Allen Key Set

Set of 7 Handy Keys Sizes: (mm) 1.4, 1.5, 2, 2.4, 2.5, 3, 4

T 1410 $1.95



Tweezers

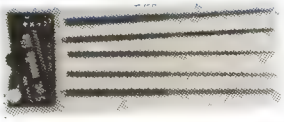
Needle Nose T 2375 $2.95
Duck Bill T 2377 $2.50
Duck Bill (self closing) T 2379 $5.95

Drill Set 11 PC

Industrial quality meets British standard 328-1959 complete with pressed steel storage case 1-6mm

T 2330 $14.50

Needle File Set



T 2350 $22.50

Use for contacts, points, general electronic work. Very handy! Set of 5 files, round, square, half round triangular and flat.

Tapered Reamer

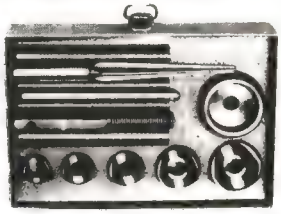
Essential for chassis work. Enlarges from 5-20mm

T 2370 $15.50

Hole Punch Set

A must for every enthusiast or serviceman. Cuts holes in metal up to 1.6mm (16 gauge). Set of 5 punches and tapered reamer.

Punch Sizes
16mm
18mm
20mm
25mm
30mm



T 2360 $69.95

Powerful 6000 RPM Mini Drill

For PC Work

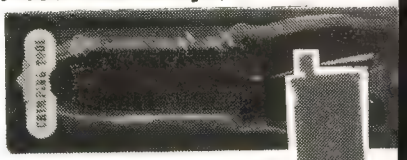
Tons of torque. Just the shot for PCB work. 12V DC operation from optional power pack. Comes with 0.8mm and 1.0mm chucks. Plus one 1.00mm drill bit.

T 2302 $21.50

Drill Bits for PCB Work
0.8mm T 2320 $3.50
1.0mm T 2325 $3.50

Crimping Tool

T 1550 Multiway $4.95



Fantastic New Heavy Duty Nibbler

Cuts any shape in steel, aluminium or plastic. Very easy to use. Capacity steel 1mm Aluminium 1.6mm

T 2355 $19.95

Cable Tie Gun

Tension cable ties in a jiffy - a must for every tool kit.

T 2345 $16.00

Mini Bench Vice

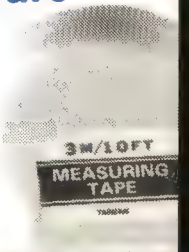
Quality die cast alloy

T 2365 $10.50

Tape Measure

3M/10F engineers tape measure. Marked in both metres and yards. Self retracting blade. Tape locking mechanism and belt clip.

T 2390 $5.95



Pearl Catch T 2380 $3.95

Super natty tool for picking up small screws nuts washers, pins and holding in place for fixing etc.

PHONEORDER TOLL FREE 008 999 007

Low Cost IC Inserters-Extractors

Inserters

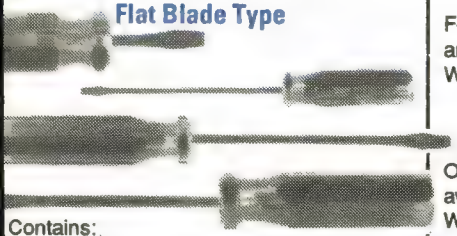
T 2520 14-16 Pin **$10.95**
T 2524 18-20 Pin **$10.95**
T 2528 24-28 Pin **$12.50**
T 2536 36-40 Pin **$12.50**

Extractor

T 2550 8-40 Pin **$2.50**

Engineers Screwdriver Set

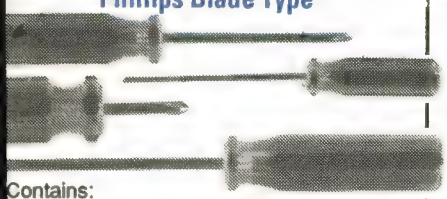
Flat Blade Type



Contains:
1 x 6mm x 90mm
1 x 6mm x 215mm
1 x 5mm x 185mm
1 x 3mm x 135mm

T 2190 **$9.80**

Phillips Blade Type



Contains:
1 x size 00 shaft 75mm
1 x size 0 shaft 78mm
1 x size 2 shaft 102mm
1 x size 2 shaft 35mm

T 2192 **$9.80**

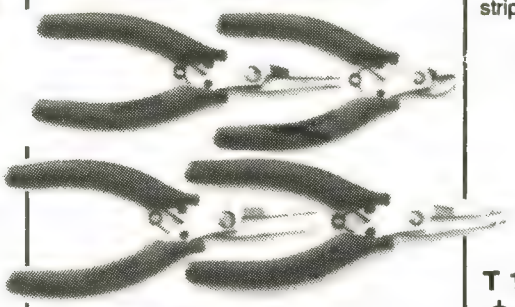
Quality Screwdrivers

Jewellers Drive Set 6 PC

T 2200 **$4.50**

General Workshop Series

All stainless steel construction with insulated handles.



Diagonal Cutter

With bevelled edge and rounded jaw profile. Cutting capacity: Copper wire 1.2mm-Steel wire 0.4mm-Length 115mm-Weight: 60g.

T 2750 **$12.95**

Long Nose Pliers

General electronic use. Length: 140mm Weight: 60g.

T 2760 **$12.95**

Flat Long Nose Plier

For bending component legs, IC pins etc. and general use. Length: 140mm Weight: 60g.

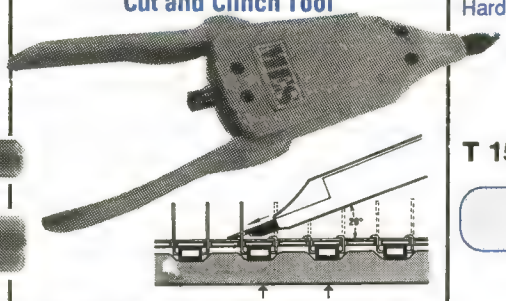
T 2770 **$12.95**

Curved Long Nose Plier

Offset jaws for working in confined and awkward spaces. Length: 135mm Weight: 60g.

T 2780 **$12.95**

Cut and Clinch Tool



- Cuts, clinches and burnishes component leads in one stroke
- Burnish improves solder wetting
- Lightweight and comfortable
- Rugged aluminum body
- Durable steel mechanism
- For production or prototypes

T 2800 **$39.50**

Wire Wrap Tool

Quality tool made in U.S.A. Suitable for wire-wrapping, stripping and unwrapping .25mm or AWG-30 wire.

T 2250 **$29.50**

Professional Wire Stripper

Designed by Elcontrol Italy

For the full time technician or for the discerning hobbyist who would like a stripper to last 20 years or more!

ADJUSTMENT
Adjust the blades for soft or w'hard sheaths
Replacement Blade System
ADJUSTABLE STOP for consistency in Wire Strip Lengths
STRIPPER can strip 25mm/1"
CUTTER

T 1522 **$16.95**

Spare Blades T 1525 **$1.95**

Professional Automatic Wire Stripper

Automatically adjusts to insulation/wire diameter

T 1520 **$10.95**

Wire Stripper

Hardened Jaws

T 1510 **$5.95**

Palm Grip Series

Diagonal Cutter

T 2700 **$9.95**

Flat Nose (Serrated) Plier

T 2710 **$9.95**

Needle Nose Plier

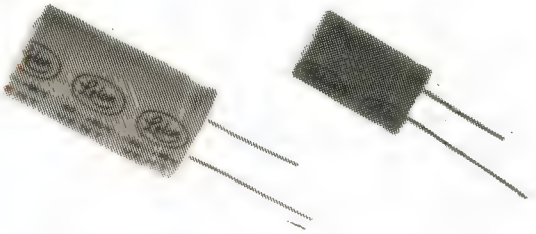
T 2720 **$9.95**

Curved Needle Nose Plier

T 2730 **$9.95**

PCB Mount (Radial) Capacitors

Features: ● Low impedance characteristics ● Case sizes are smaller than conventional general-purpose capacitors, with very high performance.
● Can size larger than 8mm diameter has safety vents on rubber bung.
● Temperature Range -40 to +85 deg. C ● Tolerance -10% to +50%



Cat.No.	uF	Working Voltage	Surge Voltage	Ripple★ Current MA	Can Diameter MM	Lead Spacing MM	1-9	10-24	25+
R 5010	.47uF	63V	79	18	5	2	.27	.23	.20
R 5018	1uF	63V	79	25	5	2	.27	.23	.20
R 5024	2.2uF	25V	32	37	5	2	.27	.23	.20
R 5028	2.2uF	63V	79	37	5	2	.27	.23	.20
R 5034	3.3uF	25V	32	46	5	2	.27	.23	.20
R 5038	3.3uF	63V	79	46	5	2	.27	.23	.20
R 5044	4.7uF	25V	32	59	5	2	.27	.23	.20
R 5048	4.7uF	63V	79	59	5	2	.27	.23	.20
R 5054	6.8uF	25V	32	71	5	2	.27	.23	.20
R 5058	6.8uF	63V	79	71	5	2	.27	.23	.20
R 5062	10uF	16V	20	86	5	2	.27	.23	.20
R 5064	10uF	25V	32	86	5	2	.27	.23	.20
R 5065	10uF	35V	44	86	5	2	.27	.23	.20
R 5068	10uF	63V	79	86	5	2	.27	.23	.20
R 5084	22uF	25V	32	87	5	2	.27	.23	.20
R 5088	22uF	63V	79	134	6.3	3.5	.35	.32	.29
R 5094	33uF	25V	32	108	6	2.5	.30	.27	.24
R 5098	33uF	63V	79	164	8	3.5	.38	.35	.32
R 5102	47uF	16V	20	120	5	2	.30	.27	.24
R 5104	47uF	25V	32	129	6	2.5	.32	.29	.26
R 5105	47uF	35V	44	108	6.3	2.5	.37	.34	.31
R 5108	47uF	63V	79	220	8	3.5	.42	.38	.35
R 5122	100uF	16V	20	176	6	2.5	.32	.29	.26
R 5124	100uF	25V	32	195	6.3	3.5	.45	.40	.36
R 5125	100uF	35V	44	246	8	3.5	.60	.55	.50
R 5128	100uF	63V	79	370	10	5	.75	.70	.65
R 5142	220uF	16V	20	272	8	3.5	.35	.30	.27
R 5144	220uF	25V	32	326	8	3.5	.60	.55	.50
R 5148	220uF	63V	79	570	13	5	.90	.85	.75
R 5154	330uF	25V	32	416	10	5	.65	.60	.55
R 5158	330uF	63V	79	766	13	5	.95	.90	.85
R 5162	470uF	16V	20	467	10	5	.60	.55	.50
R 5164	470uF	25V	32	548	10	5	.70	.65	.60
R 5165	470uF	35V	44	690	13	5	1.00	.90	.80
R 5168	470uF	63V	79	942	16	7.5	1.50	1.35	1.20
R 5182	1000uF	16V	20	751	10	5	.75	.70	.65
R 5184	1000uF	25V	32	830	13	5	.95	.90	.80
R 5185	1000uF	35V	44	1046	13	5	1.40	1.25	1.15
R 5188	1000uF	63V	79	1450	16	7.5	1.95	1.85	1.70
R 5202	2200uF	16V	20	1020	13	5	.95	.90	.80
R 5204	2200uF	25V	32	1180	16	7.5	1.40	1.30	1.15
R 5206	2200uF	50V	63	1650	18	7.5	2.90	2.65	2.40
R 5208	2200uF	63V	79	1680	22	10	4.70	4.30	3.90
R 5214	3300uF	25V	32	1268	18	7.5	1.95	1.75	1.60
R 5216	3300uF	50V	63	1680	22	10	4.70	4.30	3.90
R 5222	4700uF	16V	20	1471	16	7.5	1.60	1.50	1.35
R 5224	4700uF	25V	32	1614	18	7.5	2.75	2.50	2.25
R 5226	4700uF	50V	63	1938	25	12.5	4.98	4.60	4.10
R 5234	10000uF	25V	32	2617	25	12.5	5.98	5.50	5.00

★RIPPLE CURRENT AT 20° 100Hz

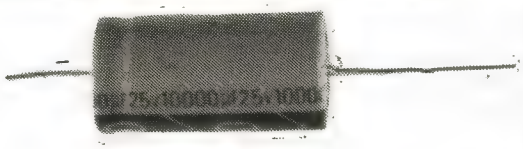
Low Profile Electrolytic Capacitor

Cat.No.	UF	Working Voltage	Surge Voltage	Ripple Current MA	Can Diameter MM	Lead Spacing MM	1-9	10+
R 5320	1000uF	35V	44V	798	18	7.5	1.98	1.87

Low profile and excellent vibration resistance makes it ideal for portable equipment.

Axial Capacitors

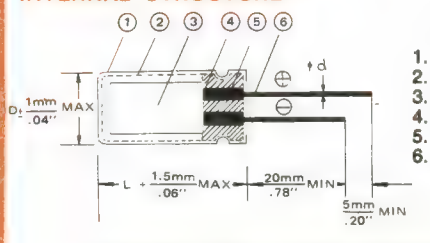
Features: ● Low impedance characteristics ● Case sizes are smaller than conventional general-purpose capacitors, with very high performance
● Can size larger than 8mm diameter has safety vents on rubber bung.
● Temperature Range -40 to +85°C ● Tolerance -10% to +50%



Cat.No.	uF	Working Voltage	Surge Voltage	Ripple★ Current MA	Can Length MM	1-9	10-24	25+
R 5518	1uF	63V	79	25	12	.35	.30	.27
R 5524	2.2uF	25V	32	37	12	.35	.30	.27
R 5528	2.2uF	63V	79	37	12	.35	.30	.27
R 5534	3.3uF	25V	32	46	12	.35	.30	.27
R 5538	3.3uF	63V	79	46	12	.35	.30	.27
R 5544	4.7uF	25V	32	59	12	.35	.30	.27
R 5548	4.7uF	63V	79	59	12	.35	.30	.27
R 5554	6.8uF	25V	32	71	12	.35	.30	.27
R 5558	6.8uF	63V	79	71	12	.35	.30	.27
R 5564	10uF	25V	32	86	12	.35	.30	.27
R 5568	10uF	63V	79	86	12	.35	.30	.27
R 5584	22uF	25V	32	87	12	.35	.30	.27
R 5594	33uF	25V	32	108	12	.40	.35	.30
R 5604	47uF	25V	32	129	12	.45	.40	.36
R 5608	47uF	63V	79	220	17	.60	.55	.50
R 5624	100uF	25V	32	195	16	.45	.40	.36
R 5628	100uF	63V	79	370	21	.70	.65	.55
R 5644	220uF	25V	32	326	17	.55	.50	.45
R 5646	220uF	50V	63	476	21	.95	.85	.75
R 5654	330uF	25V	32	416	21	.75	.70	.65
R 5658	330uF	63V	79	766	27	1.45	1.35	1.25
R 5664	470uF	25V	32	548	21	.80	.73	.65
R 5668	470uF	63V	79	942	28	1.95	1.82	1.75
R 5682	1000uF	16V	20	751	21	.95	.82	.75
R 5684	1000uF	25V	32	830	22	1.30	1.15	1.05
R 5688	1000uF	63V	79	1450	38	3.50	3.10	2.95
R 5702	2200uF	16V	20	1020	27	1.50	1.25	1.10
R 5704	2200uF	25V	32	1180	28	1.95	1.80	1.65
R 5708	2200uF	63V	79	1680	43	4.98	4.60	4.25
R 5714	3300uF	25V	32	1268	37	2.50	2.30	2.10
R5716	3300uF	50V	63	1680	43	4.95	4.50	4.95
R 5724	4700uF	25V	32	1614	38	3.60	3.30	3.00
R 5725	4700uF	35V	44	1706	43	5.65	5.20	4.90
R 5744	10000uF	25V	32	2617	52	6.95	6.40	6.05

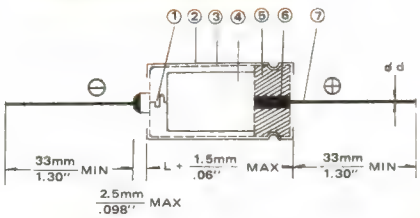
★RIPPLE CURRENT AT 20° 100Hz

INTERNAL STRUCTURE



1. Insulating Sleeve
2. Aluminium Case
3. Capacitor Element
4. Sealing Rubber
5. Aluminium Lead Wire
6. Lead Wire

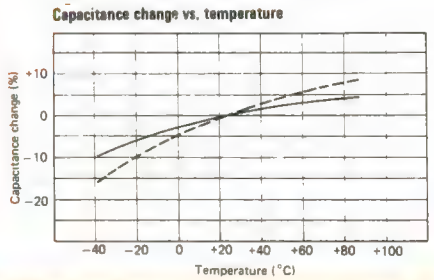
INTERNAL STRUCTURE



1. Plain Foil
2. Insulating Si
3. Aluminium C
4. Capacitor El
5. Sealing Rubb
6. Aluminium L
7. Lead Wire

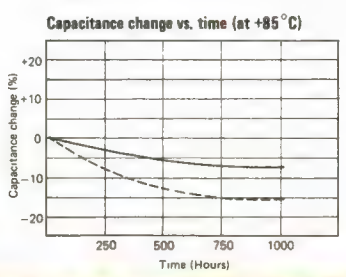
TEMPERATURE CHARACTERISTICS

R 5018 — R 5234 ----1000uF 16V
R 5518 — R 5744 ———1uF 50V



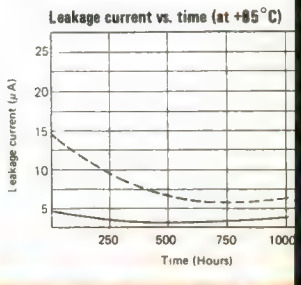
LIFE TEST

R 5018 — R 5234 ----1000uF 16V
R 5518 — R 5744 ———1uF 50V



LEAKAGE GRAPH

R 5018 — R 5234 ----1000uF 16V
R 5518 — ———



PHONEORDER TOLL FREE 008 999 007

PCB (Radial) Low Leakage Capacitors

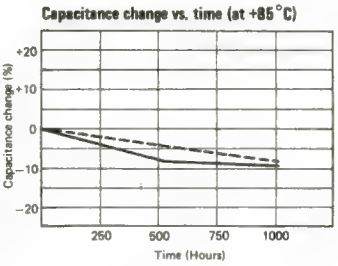
atures: Very low leakage current ● Low impedance characteristics
Long life ● Capacitance tolerance +/-20% ● Can be used as a replace-
ent for tantalum capacitor ● Temperature Range -40 to + 85deg.C

t.No.	uF	Working Voltage	Surge Voltage	Ripple Current MA	Can Diameter MM	Lead Spacing MM	ea 1-9	ea 10-24	ea 25+
6006	.1uF	50V	63	7	5	2	.35	.30	.27
6016	.15uF	50V	63	9	5	2	.35	.30	.27
6026	.22uF	50V	63	11	5	2	.35	.30	.27
6036	.33uF	50V	63	14	5	2	.35	.30	.27
6046	.47uF	50V	63	17	5	2	.35	.30	.27
6056	.68uF	50V	63	21	5	2	.35	.30	.27
6066	1uf	50V	63	25	5	2	.35	.30	.27
6076	1.5uF	50V	63	31	5	2	.35	.30	.27
6086	2.2uF	50V	63	37	5	2	.35	.30	.27
6096	3.3uF	50V	63	46	5	2	.35	.30	.27
6106	4.7uF	50V	63	55	5	2	.35	.30	.27
6115	6.8uF	35V	44	66	5	2	.35	.30	.27
6125	10uF	35V	44	72	5	2	.35	.30	.27
6135	15uF	35V	44	89	6	2.5	.35	.30	.27
6145	22uF	35V	44	106	6	2.5	.40	.35	.32
6154	33uF	25V	32	121	6	2.5	.40	.35	.32
6155	33uF	35V	44	137	8	3.5	.40	.35	.32
6164	47uF	25V	32	150	6.3	3.5	.40	.35	.32
6165	47uF	35V	44	164	8	3.5	.40	.35	.32
6174	68uF	25V	32	180	8	3.5	.40	.35	.32
6175	68uF	35V	44	220	8	3.5	.45	.40	.35
6182	100uF	16V	20	219	6.3	3.5	.45	.40	.35
6185	100uF	35V	44	269	8	3.5	.45	.40	.35
6192	220uF	16V	20	324	8	3.5	.45	.40	.35
6195	220uF	35V	44	459	10	5	.55	.50	.55
6202	330uF	16V	20	456	10	5	.45	.40	.35
6205	330uF	35V	44	564	13	5	.80	.75	.70
6212	470uF	16V	20	613	10	5	.50	.45	.40
6215	470uF	35V	44	765	13	5	.96	.90	.86

LIFE TEST

R 6006 — R 6215

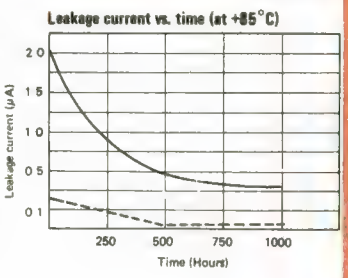
——10uF 35V ———100uF 35V



LEAKAGE GRAPH

R 6006 — R 6215

——10uF 35V ———100uF 35V

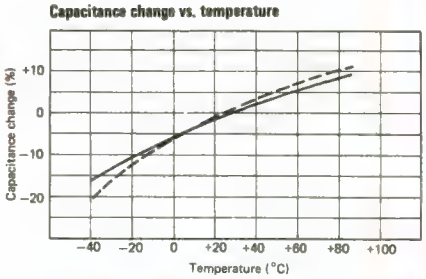


TEMPERATURE CHARACTERISTICS

R 6006 — R 6215

——10uF 35V

———100uF 35V



RADIAL BIPOLAR CAPACITORS

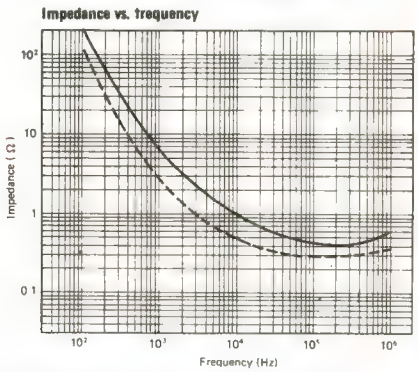
Features: Radial lead, bi-polarized, suitable for crossover network of high-pitched and low-pitched sounds in high-fidelity sound systems ● Have excellent frequency characteristics ● Low leakage current and low dissipation factor ● Temperature range -40 to +85oC ● Tolerance +/- 20% at 20°C 1kHz.

Cat.No.	uF	Working Voltage	Ripple Surge Voltage	Can Current MA	Lead Diameter MM	Spacing MM	ea 1-9	ea 10-24	ea 25+
R 6510	1uF	50V	63	30	8	3.5	.45	.40	.36
R 6520	2.2uF	50V	63	44	8	3.5	.45	.40	.36
R 6530	3.3uF	50V	63	54	8	3.5	.45	.40	.36
R 6540	4.7uF	50V	63	65	8	3.5	.45.	.40	.36
R 6550	6.8uF	50V	63	70	8	3.5	.45	.40	.36
R 6560	10uF	50V	63	88	10	5	.65	.60	.55
R 6570	22uF	50V	63	145	10	5	.75	.70	.65
R 6580	47uF	50V	63	220	13	5	1.15	1.05	.90
R 6590	100uF	50V	63	363	16	7.5	1.60	1.45	1.30

IMPEDANCE GRAPH

R 6510 — R 6590

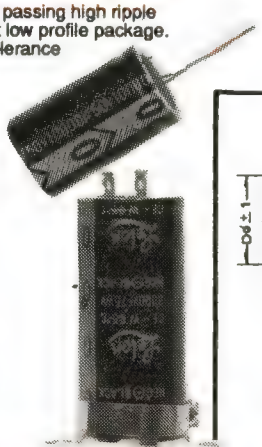
——4.7uF 50V ———22uF 50V



HASSIS ELECTROLYTICS - CAN TYPE WITH CLIP

eatures: Fixes easily to PCB or Metal Chassis ● Capable of passing high ripple
rrent ● High values of capacitance and voltage in a compact low profile package.
Operating Temperature Range -40 +85°C ● Capacitance Tolerance
- 20% (at 20oC, 100Hz)

t. No.	uf	Working Voltage	Surge Voltage	Ripple Current MA	ea 1-9	ea 10+
6710	4000uF	63V	80	1814	10.80	9.90
6720	8000uF	63V	80	2039	19.50	17.50
6730	10000uF	50V	80	2473	16.50	15.00
6712	4000uF	75V	95	2870	16.00	15.00
6722	8000uF	75V	95	4200	19.50	17.50
6740	10000uF	100V	125	5630	29.60	28.00

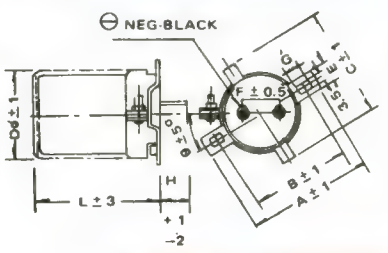


rge Capacitance Type Electrolytic With uxiliary Lead

as an auxiliary terminal (not electrically connected), which cts as a stabiliser and allows more positive fixing to PCB, to thstand vibration and transit movement.

t. No.	uF	Working Voltage	Surge Voltage	Ripple Current MA	ea 1-9	ea 10+
6820	4700uF	50V	63	2400	6.60	5.95
6825	4700uF	80V	100	3000	9.95	9.15
6840	10000uF	50V	63	3300	9.95	9.15

INTERNAL STRUCTURE



MECHANICAL SPECIFICATIONS

D0	A	B	C	E	F	G	H	0	0
30	52	42	38	10	10	6	12	45	50
35	58	48	44	10	14	7	12	30	63
35	58	48	44	10	14	7	12	30	63

DIRECT IMPORT PRICE

PHONEORDER TOLL FREE 008 999 007

PASSIVES

TANTALUM (Values in uF)

		Ea	10 Up
R 2620	.1/35V	.70	.65
R 2622	.22/35V	.70	.65
R 2624	.33/35V	.70	.65
R 2626	.47/35V	.70	.65
R 2628	1/35V	.70	.65
R 2630	1.5/35V	.75	.70
R 2632	2.2/35V	.80	.75
R 2634	3.3/35V	.70	.65
R 2635	4.7/35V	.70	.65
R 2636	4.7/35V	.95	.85
R 2637	6.8/35V	.95	.85
R 2638	10/25V	1.10	.98
R 2640	15/25V	1.10	.98
R 2642	22/16V	1.10	.98
R 2644	33/10V	1.10	.98
R 2646	47/6.3V	1.35	1.25
R 2648	100/3V	1.50	1.35

CERAMIC 50V (Values in pF)

R 2791	1pF	R 2822	100
R 2792	2	R 2823	120
R 2793	3	R 2824	150
R 2794	4	R 2825	180
R 2795	5	R 2826	220
R 2796	6	R 2827	270
R 2797	7	R 2828	330
R 2798	8	R 2829	390
R 2810	10	R 2830	470
R 2811	12	R 2831	560
R 2812	15	R 2832	680
R 2813	18	R 2833	820
R 2814	22	R 2834	.001 uF
R 2815	27	R 2837	.0022
R 2816	33	R 2840	.0033
R 2817	39	R 2842	.0047
R 2818	47	R 2843	.0056
R 2819	56	R 2844	.0068
R 2820	68	R 2845	.0082
R 2821	82	R 2846	.01
		R 2850	.022
		R 2855	.033
		R 2860	.047
		R 2865	.1

All Above .18
Per Value 10 Up .15
Per Value 100 Up .12

100V GREENCAPS (Values in uF)

		Ea	10+	100+
R 2700	.001	.25	.20	.18
R 2701	.0012	.25	.20	.18
R 2702	.0015	.25	.20	.18
R 2703	.0018	.25	.20	.18
R 2704	.0022	.25	.20	.18
R 2706	.0033	.25	.20	.18
R 2708	.0039	.25	.20	.18
R 2710	.0047	.25	.20	.18
R 2712	.0056	.25	.20	.18
R 2714	.0068	.25	.20	.18
R 2716	.0082	.25	.20	.18
R 2718	.01	.25	.20	.18
R 2719	.012	.25	.20	.18
R 2720	.015	.25	.20	.18
R 2721	.018	.25	.20	.18
R 2722	.022	.25	.20	.18
R 2724	.033	.25	.20	.18
R 2726	.039	.25	.20	.18
R 2728	.047	.28	.25	.22
R 2730	.056	.28	.25	.22
R 2732	.068	.28	.25	.22
R 2734	.082	.28	.25	.22
R 2736	.1	.28	.25	.23
R 2737	.12	.39	.35	.31
R 2738	.15	.39	.35	.31
R 2739	.18	.50	.45	.40
R 2740	.22	.50	.45	.40
R 2742	.27	.50	.45	.40
R 2744	.33	.50	.45	.40
R 2745	.39	.50	.45	.40
R 2746	.47	.69	.60	.54
R 2748	1.0	1.40	1.25	1.10
R 2750	2.2	2.10	2.00	1.50
R 2752	3.3	2.95	2.75	2.45

HIGH VOLTAGE GREENCAPS 630V

(Values in uF)		Ea	10 Up	100 Up
R 2770	.01	.35	.30	.20
R 2772	.022	.35	.30	.20
R 2774	.033	.40	.35	.30
R 2776	.047	.40	.35	.30
R 2778	.1	.90	.80	.75
R 2780	.22	1.05	.95	.80
R 2782	.33	1.30	1.15	1.05
R 2784	.47	1.35	1.20	1.10

50V MONOLITHIC CERAMICS

(Values in uF)

		Ea	10 Up	100 Up
R 2900	.001	.22	.20	.18
R 2915	.022	.22	.20	.18
R 2910	.01	.22	.20	.18
R 2920	.033	.22	.20	.18
R 2925	.047	.24	.22	.20
R 2930	.1	.24	.22	.18
R 2935	.22	.55	.50	.45
R 2940	.33	.55	.50	.45
R 2945	.47	.70	.60	.55
R 2950	1uF	1.35	1.15	1.05

VARIABLE TUNING CAPACITORS 60-160pF

R 2601 $1.75
10 Up $1.40

AC Capacitor

As used in mains isolation applications e.g. Telephone line isolation equipment. Modems etc. Suitable for PCB or chassis mounting. 2uF 440V AC

R 6900 $4.95
10 Up $4.45
100 Up $4.20

COMPONENT BULK PACKS

Convenient For Schools & Hobbyists

All computer selected values, i.e. you get more of the most used values and less of the least common. All 1st quality factory fresh.

R 3501 .25W RESISTOR PACK

Average Contents: 300 $12.00 value

Only $6.95 10 Up $5.95

R 3505 .25W RESISTOR PACK METAL FILM

Average Contents: 150

Only $5.95 10 Up $5.50

R 3510 GREENCAP PACK 100V

Average Contents: 50 $12.00 value

Only $5.95 10 Up $5.50

R 3515 CERAMIC PACK 50V

Average Contents: 100 $14.00 value

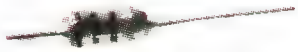
Only $5.95 10 Up $5.50

R 3520 ELECTROLYTIC PACK PCB TYPE

Average Contents: 40 $14.00 value

Only $6.50 10 Up $6.20

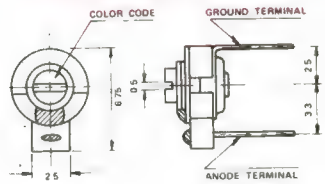
R F CHOKES



Cat.No.	Inductance uH +-10%	DC Resistance Ohm	Rated DC Current (mA) Max.
L 7010	1.0	0.19	920
L 7012	1.5	0.23	830
L 7014	2.2	0.28	750
L 7016	3.3	0.34	670
L.7018	4.7	0.39	620
L 7020	6.8	0.48	550
L 7022	10	0.58	500
L 7024	15	0.72	460
L 7026	22	0.84	410
L 7028	33	1.03	370
L 7030	47	1.22	340
L 7032	68	1.47	305
L 7034	100	1.80	275
L 7036	150	4.20	175
L 7038	220	5.10	155
L 7040	330	6.40	137
L 7042	470	7.70	126
L 7044	680	9.40	113
L 7046	1000	14.00	100
L 7048	1500	8.00	155
L 7050	2200	14.00	137
L 7052	3300	22.00	100
L 7054	4700	30.00	100

All $1.20
10 Up $1.05

TRIMMER CAPACITORS



D Series, top adjust., 2 pin, 5mm pin spacing. Colour coded for capacitance range identification.

R 4001	2-7pF	Red
R 4003	3-11pF	White
R 4005	3.5-20pF	Blue
R 4007	5-30pF	Yellow
R 4009	8.5-40pF	Brown
R 4011	8.5-50pF	Green
R 4013	8.5-70pF	Black

All $1.45
10 Up $1.30

CRYSTALS

All Parallel Resonant HC25 (Except Y 1000 - HC33 Style)

		Ea	10 Up
Y 1000	1.0MHz	$12.50	$11.50
Y 1010	3.579545	$3.95	$3.65
Y 1012	4.0	$3.95	$3.65
Y 1013	4.433619	$3.95	$3.65
Y 1015	4.77	$3.95	$3.65
Y 1020	8.0	$3.95	$3.65
Y 1025	10.0	$3.95	$3.65

RESISTORS (OEM SPECIFICATION)

Continuous Working Voltage 250V
Short Cycle working Voltage 500V

Value in OHMS	.25W Metal Film 1%	.25W Carbon Film 5%	.5W Carbon Film 5%	1W Carbon Film 5%	5W Wire Wound 5%	Value in OHMS
0.1					R 0301	0.1
0.22					R 0302	0.22
0.27					R 0303	0.27
0.33		ZERO OHM LINK ¼W SIZE R 0005 6¢			R 0304	0.33
0.39					R 0305	0.39
0.47					R 0306	0.47
0.51					R 0307	0.51
0.56					R 0308	0.56
0.68					R 0309	0.68
0.82					R 0310	0.82
1.0		R 0010	R 0095	R 0201	R 0311	1.0
1.2		R 0011	R 0096	R 0202	R 0312	1.2
1.5		R 0012	R 0097	R 0203	R 0313	1.5
1.8		R 0013	R 0098	R 0204	R 0314	1.8
2.2		R 0014	R 0099	R 0205	R 0315	2.2
2.7		R 0015	R 0100	R 0206	R 0316	2.7
3.3		R 0016	R 0101	R 0207	R 0317	3.3
3.9		R 0017	R 0102	R 0208	R 0318	3.9
4.7		R 0018	R 0103	R 0209	R 0319	4.7
5.6		R 0019	R 0104	R 0210	R 0320	5.6
6.8		R 0020	R 0105	R 0211	R 0321	6.8
8.2		R 0021	R 0106	R 0212	R 0322	8.2
10	R 0510	R 0022	R 0107	R 0213	R 0323	10
12	R 0512	R 0023	R 0108	R 0214	R 0324	12
15	R 0514	R 0024	R 0109	R 0215	R 0325	15
18	R 0516	R 0025	R 0110	R 0216	R 0326	18
22	R 0518	R 0026	R 0111	R 0217	R 0327	22
27	R 0520	R 0027	R 0112	R 0218	R 0328	27
33	R 0522	R 0028	R 0113	R 0219	R 0329	33
39	R 0524	R 0029	R 0114	R 0220	R 0330	39
47	R 0526	R 0030	R 0115	R 0221	R 0331	47
56	R 0528	R 0031	R 0116	R 0222	R 0332	56
68	R 0530	R 0032	R 0117	R 0223	R 0333	68
82	R 0532	R 0033	R 0118	R 0224	R 0334	82
100	R 0534	R 0034	R 0119	R 0225	R 0335	100
120	R 0536	R 0035	R 0120	R 0226	R 0336	120
150	R 0538	R 0036	R 0121	R 0227	R 0337	150
180	R 0540	R 0037	R 0122	R 0228	R 0338	180
220	R 0542	R 0038	R 0123	R 0229	R 0339	220
270	R 0544	R 0039	R 0124	R 0230	R 0340	270
330	R 0546	R 0040	R 0125	R 0231	R 0341	330
390	R 0548	R 0041	R 0126	R 0232	R 0342	390
470	R 0550	R 0042	R 0127	R 0233	R 0343	470
560	R 0552	R 0043	R 0128	R 0234	R 0344	560
680	R 0554	R 0044	R 0129	R 0235	R 0345	680
820	R 0556	R 0045	R 0130	R 0236	R 0346	820
1K	R 0558	R 0046	R 0131	R 0237	R 0347	1K
1.2K	R 0560	R 0047	R 0132	R 0238	R 0348	1.2K
1.5K	R 0562	R 0048	R 0133	R 0239	R 0349	1.5K
1.8K	R 0564	R 0049	R 0134	R 0240	R 0350	1.8K
2.2K	R 0566	R 0050	R 0135	R 0241	R 0351	2.2K
2.7K	R 0568	R 0051	R 0136	R 0242	R 0352	2.7K
3.3K	R 0570	R 0052	R 0137	R 0243	R 0353	3.3K
3.9K	R 0572	R 0053	R 0138	R 0244	R 0354	3.9K
4.7K	R 0574	R 0054	R 0139	R 0245	R 0355	4.7K
5.6K	R 0576	R 0055	R 0140	R 0246		5.6K
6.8K	R 0578	R 0056	R 0141	R 0247		6.8K
8.2K	R 0580	R 0057	R 0142	R 0248		8.2K
10K	R 0582	R 0058	R 0143	R 0249		10K
12K	R 0584	R 0059	R 0144	R 0250		12K
15K	R 0586	R 0060	R 0145	R 0251		15K
18K	R 0588	R 0061	R 0146	R 0252		18K
22K	R 0590	R 0062	R 0147	R 0253		22K
27K	R 0592	R 0063	R 0148	R 0254		27K
33K	R 0594	R 0064	R 0149	R 0255		33K
39K	R 0596	R 0065	R 0150	R 0256		39K
47K	R 0598	R 0066	R 0151	R 0257		47K
56K	R 0600	R 0067	R 0152	R 0258		56K
68K	R 0602	R 0068	R 0153	R 0259		68K
82K	R 0604	R 0069	R 0154	R 0260		82K
100K	R 0606	R 0070	R 0155	R 0261		100K
120K	R 0608	R 0071	R 0156	R 0262		120K
150K	R 0610	R 0072	R 0157	R 0263		150K
180K	R 0612	R 0073	R 0158	R 0264		180K
220K	R 0614	R 0074	R 0159	R 0265		220K
270K	R 0616	R 0075	R 0160	R 0266		270K
330K	R 0618	R 0076	R 0161	R 0267		330K
390K	R 0620	R 0077	R 0162	R 0268		390K
470K	R 0622	R 0078	R 0163	R 0269		470K
560K	R 0624	R 0079	R 0164	R 0270		560K
680K	R 0626	R 0080	R 0165	R 0271		680K
820K	R 0628	R 0081	R 0166	R 0272		820K
1M	R 0630	R 0082	R 0167	R 0273		1M
1.2M		R 0083	R 0168			1.2M
1.5M		R 0084	R 0169			1.5M
1.8M		R 0085	R 0170			1.8M
2.2M		R 0086	R 0171			2.2M
2.7M		R 0087	R 0172			2.7M
3.3M		R 0088	R 0173			3.3M
3.9M		R 0089	R 0174			3.9M
4.7M		R 0090	R 0175			4.7M
5.6M		R 0091	R 0176			5.6M
6.8M		R 0092	R 0177			6.8M
8.2M		R 0093	R 0178			8.2M
10M		R 0094	R 0179			10M

PRICE LIST	each	10 Up	100 Up
0.25W Metal Film	9c	-	7c ea
0.25W Carbon Film	6c	-	4c ea
0.5W Carbon Film	7c	-	5c ea
1W Carbon Film	15c	-	13c ea
5W Wire Wound	65c	60c	

INTERMEDIATE VALUE 0.25W METAL FILM

Value	Cat
11	R 0511
13	R 0513
16	R 0515
20	R 0517
24	R 0519
30	R 0521
36	R 0523
43	R 0525
51	R 0527
62	R 0529
75	R 0531
91	R 0533
110	R 0535
130	R 0537
160	R 0539
200	R 0541
240	R 0543
300	R 0545
360	R 0547
430	R 0549
510	R 5051
620	R 0553
750	R 0555
910	R 0557
1.1K	R 0559
1.3K	R 0561
1.6K	R 0563
2K	R 0565
2.4K	R 0567
3K	R 0569
3.6K	R 0571
4.3K	R 0573
5.1K	R 0575
6.2K	R 0577
7.5K	R 0579
9.1K	R 0581
11K	R 0583
13K	R 0585
16K	R 0587
20K	R 0589
24K	R 0591
30K	R 0593
36K	R 0595
43K	R 0597
51K	R 0599
62K	R 0601
75K	R 0603
91K	R 0605
110K	R 0607
130K	R 0609
160K	R 0611
200K	R 0613
240K	R 0615
300K	R 0617
360K	R 0619
430K	R 0621
510K	R 0623
620K	R 0625
750K	R 0627
910K	R 0629

9c ea

10 Up 7c ea

SPLINED SHAFT POTS

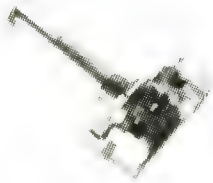
16mm Dia.
6mm x 8mm
Linear
R 2095 10K
R 2096 100K
R 2097 500K

$1.65
10 Up
$1.45

VARIABLE RESISTORS

SINGLE ROTARY POTS

6.00mm x 32mm
$1.60 ea 10 Up $1.40



Plain Shafts

LINEAR		LOGARITHMIC	
R 2001	500R	R 2020	1K
R 2003	1K	R 2022	5K
R 2005	5K	R 2024	10K
R 2007	10K	R 2026	20K
R 2010	20K	R 2028	50K
R 2012	50K	R 2030	100K
R 2014	100K	R 2031	500K
R 2015	500K	R 2032	1M
R 2016	1M	R 2034	2M
R 2018	2M		

MINIATURE SINGLE GANG

16mm dia. 6mm x 15mm shaft $1.60 ea 10 Up $1.40 ea

LINEAR		LOGARITHMIC	
R 2040	500R	R 2060	10K
R 2042	1K	R 2062	50K
R 2044	5K		
R 2046	10K		
R 2048	20K		
R 2050	50K		
R 0252	100K		
R 2054	500K		
R 2056	1M		

3 WATT WIRE WOUND

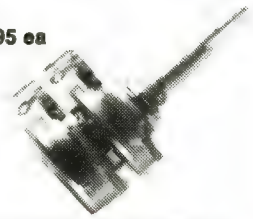
22mm Dia. 6.35mm x 47 mm
Flat Shaft $8.35 ea 10 Up $7.95

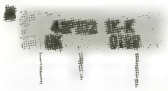
R 2150	10R	R 2160	500R
R 2152	25R	R 2162	1K
R 2154	50R	R 2163	2K
R 2156	100R	R 2164	5K
R 2158	200R	R 2166	10K

DUAL ROTARY POTS

6.35mm (1/4") x 25mm
Plain Shafts $3.20 ea 10 Up $2.95 ea

LINEAR		LOGARITHMIC	
R 2100	10K	R 2120	10K
R 2102	20K	R 2122	20K
R 2104	50K	R 2124	50K
R 2106	100K	R 2126	100K
R 2108	500K	R 2128	500K
R 2110	1M	R 2130	1M





MULTITURN TRIMPOTS

Industry Preferred Type
$2.60 ea 10 Up $2.40 ea

R 2410	100R	R 2427	20K
R 2415	200R	R 2429	50K
R 2417	500R	R 2431	100K
R 2419	1K	R 2433	200K
R 2421	2K	R 2435	500K
R 2423	5K	R 2437	1M
R 2425	10K	R 2439	2M

TRIMPOTS

MINI 2.54mm SPACING				STD 5mm SPACING			
R 2501	100	R 2516	20K	R 2551	100	R 2566	20K
R 2503	200	R 2518	50K	R 2553	200	R 2568	50K
R 2505	500	R 2520	100K	R 2555	500	R 2570	100K
R 2507	1K	R 2522	200K	R 2557	1K	R 2572	200K
R 2509	2K	R 2524	500K	R 2559	2K	R 2574	500K
R 2512	5K	R 2526	1M	R 2562	5K	R 2576	1M
R 2514	10K	R 2528	2M	R 2564	10K	R 2578	2M
45c ea	**10 Up 40c ea**			**50c ea**	**10 Up 45c ea**		

HORIZONTAL TRIMPOTS

Skeleton Type				Enclosed Type			
R 2300	100	R 2314	20K	R 2450	100	R 2462	20K
R 2302	200	R 2316	50K	R 2452	200	R 2464	50K
R 2304	500	R 2318	100K	R 2454	500	R 2466	100K
R 2306	1K	R 2320	200K	R 2456	1K	R 2468	200K
R 2308	2K	R 2322	500K	R 2457	2K	R 2470	500K
R 2310	5K	R 2324	1M	R 2458	5K	R 2472	1M
R 2312	10K	R 2326	2M	R 2460	10K	R 2474	2M
50c ea	**10 Up 45c ea**			**60c ea**	**10 Up 55c ea**		

PASSIVES

PHONEORDER TOLL FREE 008 999 007

SEMICONDUCTORS

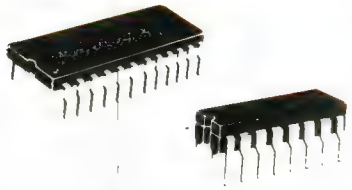
SPECIAL FET/MOSFET

		EA.	10UP
Z 1123	**MTP 3055A** N Channel Mosfet	2.75	2.50
Z 1240	**2N4342 TO-226** P Channel JFET	1.50	1.30
Z 1243	**BF245C** FET	1.70	1.60
Z 1245	**2N5458/MPF 104 TO-226** N Channel JFET	1.20	1.10
Z 1246	**2N5459/MPF 105 TO-226** N Channel JFET	1.10	1.00
Z 1248	**MFE131 TO-206** Dual Gate Mosfet	2.95	2.65
Z 1250	**2N5484 TO-92** N Channel JFET	1.25	1.10
Z 1251	**2N5485 TO-92** N Channel JFET	1.15	.95
Z 1252	**2N5486 TO-92** N Channel JFET	1.15	.95

		EA.	10UP
Z 1510	**2SK134 NCL** Power Mosfet	15.40	14.95
Z 1512	**2SJ49 PCH** Power Mosfet	15.40	14.95
Z 1520	**2SJ56** Power Mosfet	16.95	15.00
Z 1525	**2SK176** Power Mosfet	13.95	13.00
Z 1530	**BUZ71** Fet	5.50	4.95
Z 1540	**VN88AF**	9.95	9.45
Z 1560	**MTM55N10**	30.00	

UNIJUNCTION

Z 1410	**2N6027 TO-92** PROG.	1.20	1.10



LINEAR IC'S

Z 2005	**CA3130** FET Op.Amp 8 Pin Dil	3.95	3.50
Z 2010	**CA3140** FET Op.Amp 8 Pin Dil	1.65	1.35
Z 2016	**DM2502** Successive Approx.Reg.	29.75	27.50
Z 2021	**ICL7555/TLC555** CMOS Timer	1.80	1.65
Z 2501	**LM301** Op.Amp (Un-Comp)	1.20	1.10
Z 2507	**LM307** Op Amp	1.25	1.10
Z 2509	**LM308** Super Beta Op.Amp	1.95	1.75
Z 2512	**LM310** Voltage Follower	5.70	5.35
Z 2516	**LM311/UA311** Comparator	1.25	1.15
Z 2520	**LM33IN** Prec.Voltage to Freq.Convtr.	17.95	16.95
Z 2524	**LM324** Low Power Quad Op Amp	1.40	1.25
Z 2528	**LM334Z** Constant Current Source	3.50	3 20
Z 2530	**LM335Z** Volt.Mode Temp Sensor	3.95	3.75
Z 2532	**LM339** Quad Comparator	1.20	1.05
Z 2536	**LM/UA 348** Quad Op Amp	2.25	2.10
Z 2540	**LM358** L/Pwr Dual Op Amp	1.55	1.35
Z 2541	**LM359N** Hi Speed Norton Op Amp	5.95	5.50
Z 2542	**LM361** High Speed Diff. Comp.	7.50	7.30
Z 2546	**LM380** Power Amp 14 Pin Dil	3.45	3.20
Z 2550	**LM381** Low Noise Dual Pre Amp	4.90	4.55
Z 2552	**LM382** Low Noise Dual Pre Amp	4.25	3.80
Z 2554	**LM384** 5 Watt Audio Pwr Amp	5.50	4.95
Z 2556	**LM386** Low Volt.Amp.	2.40	2.20
Z 2558	**LM393** Dual Comparator	1.25	1.15
Z 2560	**LM394CH** Matched Transistor Pair	8.95	8.15
Z 2580	**LM709/UA709** Op Amp	1.60	1.50
Z 2590	**LM741** Op Amp 8 Pin Dil	.95	.90
Z 2595	**LM747** Dual Op Amp	1.90	1.80
Z 2598	**LM833** Dual Low Noise Op Amp	3.95	3.75
Z 2599	**LM1875** 20W Audio Amp	7.95	7.00
Z 2620	**LM1458/4558** Dual Op Amp	1.10	1.00
Z 2640	**LM2917** Freq.to Voltage Conv.	3.95	3.85
Z 2645	**LM/CA3080** Transcon Op Amp	1.95	1.75
Z 2650	**LM3086** Transistor Array	1.50	1.25
Z 2655	**LM3900** Quad Norton Op Amp	1.25	1.15
Z 2660	**LM3905** Precision Timer	3.20	2.95
Z 2665	**LM3909** Led Oscillator	3.30	3.10
Z 2670	**LM3914** Led Bar/ Dot Driver	6.50	5.95
Z 2672	**LM3915** Led Bar/ Dot Driver	5.95	5.45
Z 2674	**LM3916** Led Bar/ Dot Driver	5.95	5.45
Z 2690	**LM/RC4136** Quad Op Amp	2.95	2.65
Z 2700	**MC1408** 8 Bit Mult. D—A Conv.	5.10	4.90
Z 2705	**MC1488** Quad. RS-232C Trans	1.95	1.85
Z 2710	**MC1489** Quad. RS-232C RX	1.95	1.85
Z 2755	**NE555** Timer IC	.65	.60
Z 2758	**NE556** Dual Timer IC	1.40	1.25
Z 2760	**NE570** Compander IC	7.50	6.95
Z 2762	**NE571** Compander IC	4.70	4.50
Z 2790	**NE5534N** Op Amp Low Noise	2.70	2.50
Z 2792	**NE5534AN** Op Amp V/Low Noise	4.45	3.95
Z 2810	**SG2536N** Switching Reg.	8.20	7.90
Z 2861	**TL061** Lo/Pwr JFET Op Amp	1.95	1.80
Z 2862	**TL062** Lo/Pwr 2XJFET Op Amp	2.60	2.40
Z 2864	**TL064** Lo/Pwr 4XJFET Op Amp	4.50	4.10
Z 2871	**TL071** Lo/Nse JFET Op Amp	1.20	1.10
Z 2872	**TL072** Lo/Nse 2XJFET Op Amp	1.95	1.75
Z 2874	**TL074** Lo/Nse 4XJFET Op Amp	4.15	3.90
Z 2881	**TL081** GP JFET Op Amp	1.45	1.20
Z 2882	**TL082** GP 2XJFET Op Amp	1.55	1.45
Z 2884	**TL084** GP 4XJFET Op Amp	3.90	3.75
Z 2894	**TL494** Pulsewidth Mod Cont CCT	4.50	4.35
Z 2912	**MC1374P** TV Modlt. Circuit	3.75	3.40
Z 2914	**MC1377P** Col.TV RGB to PAL/NTSC Convtr.	6.95	6.50
Z 2930	**MC145026** Trinary Encoder	3.10	2.95
Z 2932	**MC145028** Trinary Decoder	3.95	3.60

MEMORY CPU AND SUPPORT

		EA.	EA. 10UP
Z 6106	**4116** MOT 16XIK Dynamic RAM	6.50	6.05
Z 6256	**41256** 256K DRAM	5.95	5.75
Z 6664	**4164/6664** 64K DRAM	8.95	8.45
Z 6800	**6800** Motorola CPU	12.50	11.25
Z 6810	**6810** MOT 128X8 STATIC RAM	6.80	6.50
Z 6821	**6821** Motorola PIA	6.50	5.95
Z 9001	**Z80A 4MHZ CPU**	5.95	5.65
Z 9005	**Z80A 4MHZ PIO**	5.95	5.65
Z 9010	**Z80A 4MHZ CTC**	6.20	5.70
Z 9107	**2732** 32K EPROM	8.95	8.10
Z 9115	**27C64** 64K EPROM	8.50	7.95
Z 9120	**27128** 128K EPROM	9.95	9.10
Z 9122	**27C128** 128K EPROM	9.95	8.95
Z 9125	**27C256** EPROM	12.95	11.95
Z 9160	**8255 P.I.A.**	6.50	6.20
Z 9170	**AY-3-1015D** 25K BAUD UART	16.75	15.75

MISC SEMI CONDUCTORS

Z 7200	**NE566** Function Generator	3.15	2.75
Z 7202	**NE567** PLL/Tone Decoder	2.25	2.10
Z 7205	**XR2206** Function Generator	10.95	10.75
Z 7216	**ICM7216AIJI** Intersil DFM IC	79.00	75.00
Z 7225	**LM3911** Temperature Control	4.80	4.35
Z 7230	**MM5369EYR/N** 50HZ TIMEBASE	6.50	6.15
Z 7231	**MM5369EST/N** 60HZ TIMEBASE	6.50	6.15
Z 7240	**MM53200** RX/TX	9.90	8.98
Z 7245	**LM34018** Hand Free Speaker Phone IC	9.95	9.50
Z 7292	**MM74C926N** 4Dig.Dis. Driver	12.50	12.00
Z 7296	**ICL7106** Dig.Dis. Driver	14.95	13.95
Z 7298	**3.5** Digit Display	12.95	12.45
Z 7300	**ZN414** AM Radio ReceiverIC	1.70	1.50
Z 7330	**TMS 3477** Digital Recorder IC	15.00	13.50
Z 7235	**MC 3334P** Transistor Assisted Ignition IC	12.95	12.45
Z 7290	**74C922** 4x4 Keyboard Decoder	9.95	9.50
Z 7315	**MC10116** Decade Decoder	3.50	3.30

MODEM IC'S

Z 9215	**7910** World Modem Chip	25.00	24.50

PHONEORDER TOLL FREE 008 999 007

TRANSISTORS

					EA.	EA. 10Up
Z 1020	**BC107** Metal Can		NPN		.65	.55
Z 1021	**BC108** Metal Can		NPN		.65	.60
Z 1023	**BC109C** Metal Can	TO-92	NPN		.80	.75
Z 1030	**BC327**	TO-92	PNP		.35	.30
Z 1031	**BC328**	TO-92	PNP		.35	.30
Z 1035	**BC337**	TO-92	NPN		.35	.30
Z 1037	**BC338**	TO-92	NPN		.35	.30
Z 1039	**BC546**	TO-92	NPN		.30	.25
Z 1040	**BC547**	TO-92	NPN		.20	.17
Z 1042	**BC548**	TO-92	NPN		.20	.17
Z 1044	**BC549**	TO-92	NPN		.20	.17
Z 1050	**BC550**	TO-92	NPN		.35	.30
Z 1052	**BC556**	TO-92	PNP		.20	.17
Z 1055	**BC557**	TO-92	PNP		.20	.17
Z 1057	**BC558**	TO-92	PNP		.20	.17
Z 1059	**BC559**	TO-92	PNP		.20	.17
Z 1061	**BC635**	TO-92	NPN		.70	.65
Z 1062	**BC636**	TO-92	PNP		.70	.65
Z 1064	**BC639**	TO-92	NPN		.60	.55
Z 1065	**BC640**	TO-92	PNP		.60	.55
Z 1068	**BD139**	TO-126	NPN		1.25	1.15
Z 1069	**BD140**	TO-126	PNP		1.25	1.15
Z 1073	**BD437**	TO-126	NPN		1.40	1.25
Z 1074	**BD438**	TO-126	PNP		1.40	1.25
Z 1078	**BD649**	TO-220	NPN		2.65	2.40
Z 1081	**BD681**	TO-126	NPN	Darlington	2.35	2.05
Z 1082	**BD682**	TO-126	PNP	Darlington	2.35	2.05
Z 1084	**BDV64B**	SOT-93	PNP		7.50	6.95
Z 1086	**BDV65B**	SOT-93	NPN		7.50	6.95
Z 1100	**BFR91A**(UHF RF Trans)				3.30	2.95
Z 1105	**BF115** RFTransistor	TO-72	NPN		1.10	1.00
Z 1110	**BF469** Philips Trans.	TO-126	NPN		1.70	1.40
Z 1112	**BF470** Philips Trans.	TO-126	PNP		1.70	1.40
Z 1114	**BU208A**	TO-3	NPN		7.70	7.35
Z 1116	**BUX80**	TO-3	NPN		5.70	5.35
Z 1117	**BU326**	TO-3	NPN		5.70	5.35
Z 1118	**MJ2955**	TO-3	PNP		2.75	2.50
Z 1120	**MJ4032**	TO-204	PNP	Darlington	21.25	20.35
Z 1121	**MJ10012**	TO-3	NPN		12.00	11.00
Z 1122	**MJ4035**	TO-204	NPN	Darlington	18.95	18.00
Z 1123	**MTP3055A-M**	TO-220	NPN		2.75	2.50
Z 1124	**MJ15003**	TO-3	NPN		7.80	7.50
Z 1125	**MJ15004**	TO-3	PNP		7.80	7.50
Z 1126	**MJE340**	TO-126	NPN		1.80	1.50
Z 1127	**MJE350**	TO-126	PNP		1.80	1.50
Z 1128	**MJE2955T**	TO-220	PNP		2.25	2.05
Z 1129	**MJE3055T**	TO-220	NPN		2.10	2.00
Z 1130	**TIP29C**	TO-220	NPN	1A	1.80	1.65
Z 1132	**TIP30C**	TO-220	PNP	1A	1.80	1.65
Z 1134	**TIP31C**	TO-220	NPN	3A	1.70	1.60
Z 1136	**TIP32C**	TO-220	PNP	3A	1.70	1.60
Z 1138	**TIP41C**	TO-220	NPN	6A	1.90	1.70
Z 1140	**TIP42C**	TO-220	PNP	6A	1.90	1.70
Z 1142	**TIP121**	TO-220	NPN	Darlington (5a)	3.95	3.65
Z 1144	**TIP126**	TO-220	PNP	Darlington	2.25	2.15
Z 1146	**TIP2955**	TO-218	PNP	15A	2.30	2.20
Z 1148	**TIP3055**	TO-218	NPN	15A	2.40	2.25
Z 1150	**TT800/2N3019**	TO-39	NPN		1.80	1.65
Z 1152	**TT801/2N4033**	TO-39	PNP		2.30	2.05
Z 1157	**MPSA56**	TO-92	PNP		1.10	1.00
Z 1160	**2N2218 A**	TO-39	NPN		1.50	1.35
Z 1164	**2N2219 A**	TO-39	NPN		1.50	1.35
Z 1166	**2N2222 A**	TO-18	NPN		.95	.90
Z 1167	**2N2905**	TO-39	PNP		1.35	1.30
Z 1168	**2N3053**	TO-39	NPN		1.35	1.20
Z 1170	**2N3054**	TO-66	NPN	4A	3.60	3.35
Z 1174	**2N3055**	TO-3	NPN	15A	2.75	2.50
Z 1177	**2N3442**	TO-3	NPN	10A	5.50	4.90
Z 1185	**2N3643**	TO-92	NPN		.29	.65
Z 1186	**2N3644**	TO-92	PNP		.70	.65
Z 1187	**2N3645**	TO-92	PNP		.60	.55
Z 1190	**2N3771**	TO-204	NPN	30A	6.30	5.85
Z 1192	**2N3773**	TO-204	NPN	16A	8.95	8.35
Z 1195	**2N3740**	TO-66	PNP	4A	6.95	6.35
Z 1200	**2N3904**	TO-92	NPN		.40	.35
Z 1201	**2N3905**	TO-92	PNP		.40	.35
Z 1230	**2N4250**	TO-92	PNP		.55	.50
Z 1235	**2N4292**	TO-92	NPN	RF	3.95	3.70
Z 1242	**2N5087**	TO-92	PNP		.75	.70

Package Formats

TO-3

TO-5

TO-18

TO-39

TO-66

TO-92

TO-126

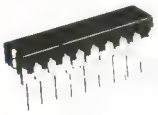
TO-220

PHONEORDER TOLL FREE 008 999 007

SEMICONDUCTORS

CMOS

		EA.	EA. 10UP
Z 4000	**4000** D. 3 Input Nor Gate	.85	.80
Z 4001	**4001** Quad 2 I/P Nor Gate	.80	.75
Z 4002	**4002** Dual 4 IP Nor Gate	.80	.75
Z 4006	**4006** 18 Stg.Stat Shift Register	1.50	1.40
Z 4007	**4007** Dual Comp PR + Inv	.90	.85
Z 4008	**4008** 4 Bit Full Adder	1.70	1.55
Z 4009	**4009** Hex Buffer Inverting	1.50	1.35
Z 4010	**4010** Hex Buffer N/Invert	1.60	1.45
Z 4011	**4011** Quad 2 IP Nand Gate	.85	.80
Z 4012	**4012** Dual 4 IP Nand Gate	.85	.80
Z 4013	**4013** Dual D Flip Flop	1.05	.95
Z 4014	**4014** 8 STG STC Shift Reg	1.70	1.20
Z 4015	**4015** Dual 4 Bit STAT Reg	1.30	1.20
Z 4016	**4016** Quad Analog Switch	1.20	1.15
Z 4017	**4017** Decade Counter Driver	1.40	1.30
Z 4018	**4018** Reset. Divide-BY-N	1.90	1.70
Z 4019	**4019** Quad And OR SLT Gate	3.50	3.20
Z 4020	**4020** 14 Stage Bin Counter driver	1.80	1.60
Z 4021	**4021** 8 STG STAT Shift Register	1.80	1.60
Z 4022	**4022** Divide by 8 Counter divider	1.80	1.60
Z 4023	**4023** Triple 3 IPT Nand Gate	.95	.90
Z 4024	**4024** 7 Stage Binary Counter Divider	1.05	.95
Z 4025	**4025** Triple 3 IPT Nor GT	.95	.90
Z 4026	**4026** Decade CTR-7-Seg Output	3.40	3.20
Z 4027	**4027** Dual JK Flip Flop	1.10	1.05
Z 4028	**4028** BCD-TO-Decimal Decoder	1.45	1.30
Z 4029	**4029** Presetable UP/DN Counter	1.80	1.60
Z 4030	**4030** Quad 2 IPT Ex. Or Gate	1.10	1.05
Z 4032	**4032** Triple Serial Adder	3.65	3.35
Z 4034	**4034** 8-ST/TRI—ST BI—DIR I/O Bus Reg	4.50	4.10
Z 4035	**4035** 4 Bit Shift Reg	2.00	1.90
Z 4040	**4040** 12 STG Binary CTR	1.80	1.60
Z 4042	**4042** Quad Clocked D Latch	1.40	1.30
Z 4043	**4043** Quad Nor RS Latch	1.40	1.30
Z 4046	**4046** Micropower PLL	2.10	2.00
Z 4047	**4047** Low Pwr Mono/Asta M/VIB	4.50	4.10
Z 4049	**4049** Hex Inverting Buffer	1.15	1.05
Z 4050	**4050** Hex Buffer (Non/Inv)	1.15	1.05
Z 4051	**4051** 8 CH A/Log Multiplx	1.95	1.90
Z 4052	**4052** 4 CH A/Log Multiplexer	1.45	1.40
Z 4053	**4053** TPL 2 CH A/Log Multiplexer	1.70	1.60
Z 4060	**4060** 14 Bit Counter	1.70	1.60
Z 4066	**4066** Quad A/Log Switch	1.15	1.05
Z 4068	**4068** 8 Input Nand Gate	.95	.90
Z 4069	**4069** Hex Inverter	.80	.75
Z 4070	**4070 Quad 2 Input Ex-or gate**	.80	.75
Z 4071	**4071** Quad 2 Input Or Gate	.80	.75
Z 4073	**4073** TPL 3 Input And Gate	.80	.75
Z 4075	**4075** TPL 3 Input And Gate	.80	.75
Z 4076	**4076** Quad D Flip Flop	1.70	1.60
Z 4077	**4077** Quad Excl Nor gate	.85	.80
Z 4078	**4078** 8 Input Nor gate	.75	.70
Z 4081	**4081** Quad 2 Input And Gate	.85	.80
Z 4082	**4082** Quad 4 Input And Gate	.85	.80
Z 4093	**4093** Quad 2 Input Nand Sch/Trig	1.30	1.20
Z 4161	**4161** Binary Counter A/S	1.85	1.70
Z 4501	**4501** Triple Gate	.90	.85
Z 4502	**4502** Strobed Hex Inv.	1.90	1.80
Z 4503	**4503** Hex N/Inv Tri-St Buffer	1.30	1.20
Z 4508	**4508** Dual 4 Bit Lach	4.20	3.90
Z 4510	**4510** BCD Up DN Counter	2.30	2.20
Z 4511	**4511** BCD to 7 SEG DCDR/DR	2.30	2.20
Z 4512	**4512** 8 CHData Selector	1.70	1.60
Z 4514	**4514** 4-16 LN DCDR/4 BT LT	4.50	4.25
Z 4516	**4516** Binary Up DN Cntr	1.95	1.90
Z 4518	**4518** BCD Up Counter	1.95	1.90
Z 4520	**4520** Dual Binary Up Cntr	1.95	1.90
Z 4521	**4521** 24 Stage Freq Divider	3.70	3.45
Z 4526	**4526** Prog 4 BT BI Counter	1.90	1.80
Z 4528	**4528** Dual Mono Multi	2.00	1.90
Z 4538	**4538** Dual Mono/Freq Multiplexer	2.10	2.00
Z 4543	**4543** BCD-7SEG LT/DC/DR/LCD	2.10	2.00
Z 4553	**4553** 3 Digit BCD Counter	4.90	4.60
Z 4557	**4557** 1-64 BIT V/LNG Sift Reg	6.95	6.40
Z 4566	**4566** Industrial Time Base Gen	3.15	2.95
Z 4568	**4568** Phase Comp.Prog Counter	4.50	4.10
Z 4581	**4581** 4Bit Arithmetic L.Unit	5.95	5.50
Z 4582	**4582** Look Ahead Carry BLK	2.40	2.20
Z 4583	**4583** Dual Schmitt Trigger	2.10	2.00
Z 4584	**4584** Hex Schmitt Trigger	1.15	1.05
Z 8450	**74C14/40106** Hex Schmitt Trig.	1.50	1.35

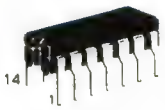


74/74LS/74HC SERIES

Please note we have listed the relevant last device digits only with this table e.g. device '**10**' is available as **7410** (Z 7410) **74LS10** (Z 8010) and **74HC10** (Z 8510). We have adopted this approach to enable you to ascertain at a glance type availability in the different families.

		7400 SERIES			74LS SERIES			74HC SERIES		
00	Quad. 2 I/P Nand Gate	Z 7400	1.30	1.15	Z 8000	.70	.65	Z 8500	.85	.80
01	Quad. 2 I/P Nand Gate	Z 7401	1.30	1.15	Z 8001	.70	.65			
02	Quad. 2 I/P Nor Gate	Z 7402	1.30	1.15	Z 8002	.70	.65	Z 8502	.85	.80
03	Quad. 2 I/P Nand Gate (O/C)	Z 7403	1.30	1.15	Z 8003	.70	.65			
04	Hex Inverter	Z 7404	1.30	1.15	Z 8004	.70	.65	Z 8504	.85	.80
05	Hex Inverter (O/C)	Z 7405	1.30	1.15	Z 8005	.70	.65			
06	Hex Inverter Buffer Dvr (O/C)	Z 7406	1.30	1.15						
07	Hex Buff/Dvr (O/C)	Z 7407	1.30	1.15						
08	Quad. 2 I/P And Gate	Z 7408	1.30	1.15	Z 8008	.70	.65	Z 8508	.85	.80
09	Quad. 2 I/P And Gate	Z 7409	1.30	1.15	Z 8009	.70	.65			
10	Triple I/P Nand Gate	Z 7410	1.30	1.15	Z 8010	.70	.65	Z 8510	.85	.80
11	Triple I/P And Gate	Z 7411	1.30	1.15	Z 8011	.70	.65			
12	Triple I/P Nand Gate (O/C)	Z 7412	1.30	1.15	Z 8012	.70	.65			
13	Dual Nand Gate Schmitt Trigger	Z 7413	1.30	1.15	Z 8013	1.45	1.30			
14	Hex Schmitt Trigger	Z 7414	1.80	1.65	Z 8014	.95	.90	Z 8514	1.50	1.40
17	Hex Buffer Dvr (O/C)	Z 7417	1.30	1.15						
20	Dual 4 I/P Nand Gate	Z 7420	1.30	1.15	Z 8020	.95	.90	Z 8520	.85	.80
21	Dual 4 I/P And Gate	Z 7421	1.30	1.15	Z 8021	.95	.90			
23	Dual 4 I/P Nand Gate W/Strobe	Z 7423	1.30	1.15						
25	Dual 4 I/P Nor Gate W/Strobe	Z 7425	1.30	1.15						
27	Triple 3 I/P Nor gate	Z 7427	1.30	1.15	Z 8027	.95	.90			
30	8 I/P Nand Gate	Z 7430	1.30	1.15	Z 8030	.95	.90	Z 8530	.85	.80
32	Quad. 2 I/P Or Gate	Z 7432	1.30	1.15	Z 8032	.95	.90	Z 8532	.85	.80
33	Quad. 2 I/P Nor Gate (O/C)				Z 8033	1.10	1.00			
37	Quad. 2 I/P Nand Buffer	Z 7437	1.30	1.15	Z 8037	.95	.90			
40	Dual 4 I/P Nand Buffer	Z 7440	1.30	1.15						
42	BCD to Decimal Decoder (O/C)	Z 7442	1.85	1.70	Z 8042	1.10	1.00	Z 8542	2.15	2.05
47	BCD to 7 Seg Dec/Driver	Z 7447	2.20	2.10	Z 8047	1.80	1.65			
48	BCD to 7 Seg Dec/Driver				Z 8048	1.80	1.65			
49	BCD to 7 Seg Dec/Driver				Z 8049	1.95	1.75			
50	DL 2W 2 I/P A/O Inv Gate	Z 7450	1.40	1.30						
51	And/Or Inv Gate	Z 7451	1.40	1.30						
53	Exp 4W A/O Inv Gate	Z 7453	1.40	1.30						
54	4W And/Or Inv Gate	Z 7454	1.40	1.30	Z 8054	.95	.90			
60	Dual 4 I/P Expander	Z 7460	1.40	1.30						
70	And Gated JK Flip Flop	Z 7470	1.30	1.15						
72	And Gated JK Flip Flop	Z 7472	1.50	1.35						

PHONEORDER TOLL FREE 008 999 007



74/74LS/74HC SERIES Continued

Please note we have listed the relevant last device digits only with this table e.g. device '10' is available as **7410** (Z 7410) **74LS10** (Z 8010) and **74HC10** (Z 8510). We have adopted this approach to enable you to ascertain at a glance type availability in the different families.

		7400 SERIES			74LS SERIES			74HC SERIES		
73	Dual JK FF W/—Clear	Z 7473	1.50	1.35	Z 8073	1.20	1.10	Z 8573	2.05	1.95
74	Dual D Type F/F	Z 7474	1.50	1.35	Z 8074	1.20	1.10	Z 8574	1.10	1.05
75	4 Bit Bistable Latch	Z 7475	1.70	1.55	Z 8075	1.20	1.10			
76	Dual JK Flip Flop	Z 7476	1.85	1.70	Z 8076	1.60	1.50	Z 8576	1.70	1.60
78	Dual JK Flip Flop				Z 8078	1.40	1.25			
82	4 Bit Binary Full Adder	Z 7482	4.80	4.40						
83	4 Bit Full Adder	Z 7483	2.20	2.10	Z 8083	1.95	1.90			
85	4 Bit Magnitude Comp	Z 7485	2.35	2.15	Z 8085	1.45	1.35	Z 8585	3.15	2.95
86	Quad. Excl.Or Gate	Z 7486	1.55	1.45	Z 8086	.95	.90	Z 8586	1.10	1.05
90	Decade Counter	Z 7490	1.85	1.70	Z 8090	1.10	1.00			
91	8 Bit Shift Reg	Z 7491	2.70	2.50						
92	Divide By 12 Counter	Z 7492	1.95	1.75	Z 8092	1.35	1.20			
93	4 Bit Binary Counter	Z 7493	1.70	1.55	Z 8093	1.35	1.20			
94	4 Bit Shift Reg	Z 7494	4.50	4.10						
95	4 Bit Shift Reg	Z 7495	2.45	2.15	Z 8095	1.45	1.35			
100	8 Bit Bistable Latch	Z 7700	4.30	3.95						
107	Dual JK Flip Flop	Z 7707	1.80	1.65	Z 8107	.95	.90	Z 8607	1.10	1.05
109	Dual JK Flip Flop	Z 7709	1.55	1.45	Z 8109	.95	.90			
112	Dual JK Flip Flop				Z 8112	.95	.90			
121	Monostable Multivibrator	Z 7721	1.80	1.65						
122	Retriggerable Mono Multivibrator	Z 7722	1.80	1.65	Z 8122	1.40	1.30			
123	Dual Retriggerable Mono Multivibrator	Z 7723	1.80	1.65	Z 8123	1.30	1.15			
125	Quad. Tri State Buffer	Z 7725	1.70	1.55	Z 8125	1.65	1.55			
126	Quad. Tri State Buffer				Z 8126	1.20	1.10			
132	Quad. 2 I/P Nand Schmitt Trig.	Z 7732	2.25	2.10						
138	Decoder/Demultiplexer				Z 8138	1.20	1.10			
139	Decoder/Demultiplexer				Z 8139	1.45	1.35			
141	BCD to Dec Decoder/Drv	Z 7741	3.45	3.15						
143	Counter/Latch Decoder/Drv	Z 7743	8.75	8.10						
147	10 I/P Priority Encoder				Z 8147	2.95	2.70			
148	8 I/P Priority Encoder				Z 8148	2.95	2.70			
151	8 I/P Multiplexer				Z 8151	1.35	1.25	Z 8651	2.00	1.90
153	Dual 4 I/P Multiplexer				Z 8153	1.35	1.25			
155	Dual Decoder/Demultiplexer				Z 8155	1.20	1.10			
156	Dual Decoder/Demultiplexer				Z 8156	1.40	1.30			
157	Quad. 2 I/P Multiplexer				Z 8157	1.45	1.35	Z 8657	2.00	1.90
158	Quad. 2 I/P Multiplexer				Z 8158	1.45	1.35			
160	BCD Decade Counter	Z 7760	4.20	3.85	Z 8160	1.45	1.35	Z 8660	2.00	1.90
161	4 Bit Binary Counter	Z 7761	3.95	3.65	Z 8161	1.60	1.50			
162	BCD Decade Counter	Z 7762	4.10	3.75	Z 8162	1.60	1.50			
163	4 Bit Binary Counter				Z 8163	1.60	1.50	Z 8663	2.00	1.90
164	8 Bit Shift Register				Z 8164	1.65	1.55	Z 8664	2.00	1.90
165	8 Bit Shift Register				Z 8165	1.95	1.85	Z 8665	2.00	1.90
166	8 Bit Shift Register				Z 8166	1.70	1.60			
173	4 Bit D Type Register	Z 7773	2.75	2.60	Z 8173	1.70	1.60	Z 8673	2.00	1.90
174	Hex D Type Flip Flop				Z 8174	.90	.80	Z 8674	1.50	1.40
175	Quad.D Type Flip Flop				Z 8175	1.50	1.40	Z 8675	1.50	1.40
178	4 Bit Univ Shift Register	Z 7778	3.50	3.20						
190	U/D Decade Counter	Z 7790	1.85	1.70	Z 8190	2.10	2.00			
191	U/D Binary Counter	Z 7791	2.10	1.95	Z 8191	2.10	2.00			
192	U/D Decade Counter	Z 7792	4.20	3.85	Z 8192	2.10	2.00			
193	U/D Binary Counter	Z 7793	2.95	2.90	Z 8193	1.70	1.60	Z8693	2.30	2.10
194	4 Bit R/L Shift Register				Z 8194	1.45	1.35			
195	4 Bit Shift Register				Z 8195	1.60	1.50	Z 8695	2.00	1.90
221	Dual Monostable Multivibrator				Z 8221	1.45	1.35			
240	Octal Inv B/L Dvr				Z 8240	2.20	2.10	Z 8740	2.00	1.90
241	Octal Bus Line Driver				Z 8241	2.10	2.00			
244	Octal 3 State Driver				Z 8244	2.50	2.40	Z 8744	2.20	2.00
245	Octal 3 State Transceiver				Z 8245	3.10	2.90	Z 8745	2.20	2.00
257	Quad. 2 I/P Multiplexer				Z 8257	1.40	1.30			
258	Quad. 2 I/P Multiplexer				Z 8258	1.20	1.10			
259	8 Bit Address Latch				Z 8259	1.70	1.60			
266	Quad. Exclusive Nor				Z 8266	1.40	1.30			
273	Octal D Type Flip Flop				Z 8273	2.25	2.10			
365	Hex Buffer	Z 7910	2.10	1.95	Z 8365	1.20	1.10			
366	Hex Inverter				Z 8366	1.20	1.10			
367	Hex Buffer				Z 8367	1.20	1.10			
368	Hex Inverter				Z 8368	1.20	1.10			
373	Octal Transparent Latch				Z 8373	2.25	2.10			
374	Octal D Type Flip Flop				Z 8374	2.25	2.10			
377	Octal D Type Flip Flop				Z 8377	2.10	2.00			
390	Dual Decade Counter	Z 7920	2.60	2.30						
393	Dual 4 Bit Shift Register	Z 7923	4.70	4.50	Z 8393	1.70	1.60			
426	Quad. Gate	Z 7928	3.30	3.10						
629	Volt Control Oscillator				Z 8429	6.60	6.15			
670	Register File				Z 8435	1.50	1.35			

PHONEORDER TOLL FREE 008 999 007

SEMICONDUCTORS

DIODES

		EA.	EA. 10UP
Z 0024	**BAW62/BAW76** Diode	.20	.17
Z 0029	**OA90** Ger.Diode	.35	.30
Z 0030	**OA91** Ger.Diode	.35	.30
Z 0035	**OA95** Ger.Diode	.35	.30
Z 0060	**5082-2800** Schottky Diode	2.50	2.25
Z 0101	**1N914/1N4148** Diode	.05	.04
Z 0105	**1N4002** 100V 1 Amp	.10	.08
Z 0109	**1N4004** 400V 1 Amp	.15	.10
Z 0112	**1N4007** 1000V 1 Amp	.20	.14
Z 0115	**1N5404** 400V 3 Amp	.30	.26
Z 0118	**1N5408** 1000V 3 Amp	.45	.40
Z 0120	**R250H** 400V 6 Amp	1.10	1.00
Z 0122	**IN3493** Pressfit 30 Amp 200V	5.75	5.45
Z 0123	**IN3493R** Pressfit 30 Amp 200V	5.75	5.45
Z 0125	**BYX71** 600 7Amp	5.30	4.95

DIODE BRIDGES

Z 0130	**WO2** Bridge 200V 1.2 Amp	.85	.75
Z 0132	**WO4** Bridge 400V 1.2 Amp	1.10	.95
Z 0134	**PWO4** Bridge 400V 6 Amp	2.30	2.10
Z 0137	**FB3502 Bridge 200V** 35 Amp	5.50	5.15
Z 0139	**FB3504** 400V 35A Bridge	6.95	6.50

ZENERS

.5 WATT

All	One	Price..25ea.	10Up. .	.20ea
Z 0303	3V3	1N746	Z 0330	11V 1N962
Z 0306	3V6	1N747	Z 0332	12V 1N963
Z 0308	3V9	1N748	Z 0334	13V 1N964
Z 0310	4V3	1N749	Z 0336	15V 1N965
Z 0312	4V7	1N750	Z 0338	18V 1N967
Z 0314	5V1	1N751	Z 0340	20V 1N968
Z 0316	5V6	1N752	Z 0342	22V 1N969
Z 0318	6V2	1N753	Z 0344	24V 1N970
Z 0320	6V8	1N754	Z 0346	27V 1N971
Z 0322	7V5	1N755	Z 0348	30V 1N972
Z 0324	8V2	1N756	Z 0350	33V 1N973
Z 0326	9V1	1N757	Z 0352	36V 1N974
Z 0328	10V	1N758		

1 WATT

All	One	Price. .35	10 Up. . .30		
Z 0603	3V3	IN4728	Z 0630	11V	IN4741
Z 0606	3V6	IN4729	Z 0632	12V	IN4742
Z 0608	3V9	IN4730	Z 0634	13V	IN4743
Z 0610	4V3	IN4731	Z 0636	15V	IN4744
Z 0612	4V7	IN4732	Z 0637	16V	IN4745
Z 0614	5V1	IN4733	Z 0638	18V	IN4746
Z 0616	5V6	IN4734	Z 0640	20V	IN4747
Z 0618	6V2	IN4735	Z 0642	22V	IN4748
Z 0620	6V8	IN4736	Z 0644	24V	IN4749
Z 0622	7V5	IN4737	Z 0646	27V	IN4750
Z 0624	8V2	IN4738	Z 0648	30V	IN4751
Z 0626	9V1	IN4739	Z 0650	33V	IN4752
Z 0628	10V	IN4740	Z 0652	38V	IN4753
			Z 0675	75V	IN4761

5 WATT

All	One	Price.1 .15ea.	10Up. .1.05ea
Z 0403	3V3		
Z 0405	5V1	Z 0415	15V
Z 0409	9V1	Z 0418	18V
Z 0412	12V	Z 0422	22V
Z 0413	13V	Z 0424	24V

LEDS

		EA.	EA. 10UP
Z 0140	Led **3mm Red**	.20	.18
Z 0141	Led **3mm Green**	.30	.25
Z 0143	Led **3mm Yellow**	.30	.25
Z 0145	Led **3mm Orange**	.30	.25
Z 0149	Led **5mm Red H/Int.**	.45	.38
Z 0150	Led **5mm Red**	.20	.16
Z 0151	Led **5mm Green**	.25	.22
Z 0152	Led **5mm Yellow**	.25	.22
Z 0154	Led **5mm Orange**	.25	.22
Z 0155	Led **10mm Red**	.95	.90
Z 0157	Led **10mm Green**	.95	.90
Z 0159	Led **10mm Yellow**	.95	.90
Z 0160	Led **Rectangular Red**	.25	.22
Z 0162	Led **Rectangular Green**	.30	.28
Z 0164	Led **Rectangular Yellow**	.30	.28
Z 0172	Led **Infra Red CQY89A**	1.20	1.10
Z 0175	Led **Tricolour**	.70	.65
Z 0180	Bar Graph 10 Seg Red	4.30	3.95
Z 0181	Led **5mm Flashing Red**	1.80	1.70
Z 0182	Led **5mm Flashing Green**	1.80	1.70

7 SEGMENT DISPLAY

Z 0184	**HP7301** Display C/Anode 0.3"	3.90	3.75
Z 0187	**HP7303** Display C/Cath. 0.3"	3.90	3.75
Z 0190	**FND500**/HD1133R .5" Disp.C/Cathode	2.90	2.65
Z 0191	**FND507**/HD1131R .5" Disp.C/Anode	3.50	3.20

OPTO

Z 1600	**FPT100** Photo Transistor	1.60	1.50
Z 1610	**MEL12** Darlington Photo trans	1.30	1.20
Z 1620	**Light Dependant Resistor**	6.95	6.50
Z 1635	**BPW50** Infra Red Diode	3.45	3.20
Z 1642	**MOC3021** OPTO Coupler	2.95	2.75
Z 1644	**MOC3041**TRIAC CPLR Zero Crossing	3.45	3.20
Z 1645	**4N28** OPTO Coupler	1.70	1.60

VOLTAGE REGULATORS

FIXED

Z 0460	**78L05** 5V 100mA Reg.	1.25	1.15
Z 0462	**78L12** 12V 100mA Reg.	1.25	1.15
Z 0464	**78L15** 15V 100mA Reg.	1.25	1.15
Z 0466	**79L05** -5V 100mA Reg.	1.25	1.15
Z 0468	**79L12** -12V 100mA Reg.	1.25	1.15
Z 0470	**79L15** -15V 100mA Reg.	1.25	1.15
Z 0505	**7805** +5V 1 Amp Reg. TO-220	1.25	1.10
Z 0506	**7806** +6V 1 Amp Reg. TO-220	1.25	1.10
Z 0508	**7808** +8V Pos.Reg. TO-220	2.50	2.25
Z 0510	**7812** +12V 1 Amp Reg. TO-220	1.25	1.10
Z 0512	**7815** +15V 1 Amp Reg. TO-220	1.25	1.10
Z 0514	**7824** +24V 1 Amp Reg. TO-220	1.25	1.10
Z 0525	**7905** -5V 1 Amp Reg. TO-220	1.25	1.10
Z 0526	**7906** -6V 1 Amp Reg. TO-220	1.25	1.10
Z 0527	**7908** -8V Neg. Reg. TO-220	1.25	1.10
Z 0528	**7912** -12V 1 Amp Reg. TO-220	1.25	1.10
Z 0530	**7915** -15V 1 Amp Reg. TO-220	1.25	1.10
Z 0532	**7924** -24V 1 Amp Reg. TO-220	1.25	1.10
Z 0540	**UA7805KC/LM309K** +5V 1.5A Reg.TO-3	3.40	3.25
Z 0542	**UA7812KC** +12V 1.5A Reg.TO-3	3.40	3.25
Z 0558	**LM336V-5** 5V 10mA reg.	2.95	2.65

VOLTAGE REGULATORS

ADJUSTABLE

		EA.	EA. 10UP
Z 0545	**LM317T** 2-30V 1A ADJ. TO-220	2.95	2.85
Z 0550	**LM317K** 2-30V 3A ADJ. TO-3	6.95	6.50
Z 0560	**LM337K** -VE 2-30V 3A ADJ.TO-3	12.50	11.95
Z 0562	**LM337T** 2-30V 1A Adj TO—220	4.55	4.35
Z 0565	**LM338K** +VE Adj.Reg. 5A TO-3	15.95	15.50
Z 0570	**LM350K** +VE ADJ. Reg. 3A TO-3	15.95	15.50
Z 0580	**LM396K** +VE ADJ. Reg. 10A TO-3	31.95	30.95
Z 0585	**LM723CN** ADJ.+/-VE Reg TO-5	1.45	1.40
Z 0590	**UC3906** Power Controller	11.95	11.45

TRIACS,TRIGGERS,

Z 1710	**BT136/500** TRIAC 500V/4A	2.45	2.20
Z 1712	**BT137/500** TRIAC 500V/8A	2.45	2.20
Z 1715	**BT138/500** TRIAC 500V/12A	3.50	3.20
Z 1720	**BT139/500** TRIAC 500V/16A	3.80	3.45
Z 1722	**SC146D** TRIAC 400V/10A	4.95	4.50
Z 1735	**MAC320** TRIAC 600V/8A Insl.Tab	2.95	2.65

DIACS

Z 1745	**ST2/BR100** Diac	.95	.90
Z 1750	**ST4** Diac (Equiv HT32)	1.95	1.75

SCR'S

Z 1765	**C103B/MCR100** SCR 200V/.8A	1.70	1.55
Z 1768	**C106D** SCR 400V/4A TO126	1.50	1.40
Z 1769	**C106Y** SCR 30V/4A Sensitive Gate	1.10	1.00
Z 1774	**C122E/BT151** 500V/8A	3.40	3.15

TRANSORBS

Z 0128	**BZT03C13** Transient Diode	2.95	2.65
Z 0129	**BZT03C62** Transient Diode	2.95	2.65

PHONEORDER TOLL FREE 008 999 007

NATIONAL SEMICONDUCTOR CORP. LINEAR APPLICATIONS DATA BOOK

An extremely useful volume for the engineer. This databook provides a fully indexed and cross-referenced collection of linear integrated circuit applications using both monolithic and hybrid circuits from National Semiconductor.

B 1235 $24.00

BUY ALL 3 VOLUMES FOR $65.00 AND SAVE $7.00

NATIONAL SEMICONDUCTOR CORP. LINEAR DATA BOOK

Vol 1

Information on voltage regulators, op amps, buffers, volt. comparators.

B 1220 $24.00

Vol 2

Information on active filters, analog switches, AD convertors, DA convertors, sample and hold, temp. sensors.

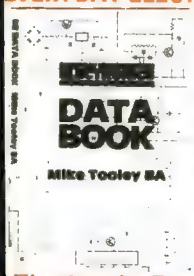
B 1225 $24.00

Vol 3

Information on audio, radio, video circuits., motion control.

B 1230 $24.00

EVERYDAY ELECTRONICS DATA BOOK



An invaluable source of information of everyday relevance in electronics. Deals with the essential theory of electronic circuits and a wide range of practical electronic applications, from power supplies to microcomputer systems. Ideal for the hobbyist, student, technician and engineer.
200 Pages

B 2300 $19.95

Electronic Power Supply Handbook

- Covers many types of supplies - batteries, simple AC supplies, switch-mode supplies and inverters
- Includes stabilisation and regulators
- Explains operating principles and gives typical circuits
- For technicians, students and enthusiasts

This book covers the often neglected topic of electronic power supplies. All types of supplies that are used for electronics purposes are covered in detail, starting with cells and batteries and extending by way of rectified supplies and linear stabilisers to modern switch-mode systems, IC switch-mode regulators, DC-DC converters and inverters.
The devices, their operating principles and typical circuits are all dealt with in detail. The action of rectifiers and the reservoir capacitor is emphasised, and the subject of stabilisation is covered.

B 2282 $17.95

Short Wave Frequency List

- For the shortwave listening enthusiast
- Handy pocket size reference book
- Lists the world's short wave stations. Listening to the world is an absorbing and fascinating hobby enjoyed by many thousands of radio enthusiasts all over the world. This book will enable radio enthusiasts to locate and identify radio stations broadcasting from all corners of the globe. It lists the world's short wave stations transmitting on frequencies from 2260kHz to 21810kHz. Stations operating at 1KW or more are included in the list which gives the station output power, frequency and location. 96 pages.

B 2275 $12.50

Introducing Digital Audio: CD, DAT & Sampling

- For enthusiasts, technicians and students • Covers CD and DAT • Digital techniques explained non-mathematically. Digital audio involves methods and circuits that are totally alien to the technician or keen amateur who has previously worked with audio circuits. This book is intended to bridge the gap of understanding for the technician and enthusiast. The principles and methods will be explained, but the mathematical background and theory will be avoided other than to state the end product. 112 pages.

B 2270 $13.95

ELECTRONICS — Build and Learn.

Second Edition

- Practical basic introduction for beginner and student combines theory with practice • Practical tests and experiments throughout • New chapter on logic circuits. The first chapter gives full constructional details of a circuit demonstrator unit that is used in subsequent chapters to introduce common electronic components - resistors, capacitors, transformers, diodes, transistors, thyristors, fets and op amps.

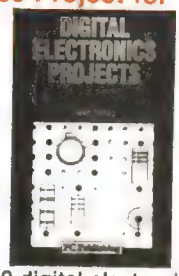
B 2265 $13.95

Electronic Test Equipment Handbook

- For students, enthusiasts, technicians and engineers
- Principles of operation described
- Practical applications covered in most applications of electronics, test instruments are essential for checking the performance of a system or for diagnosing faults in operation, and so it is important for engineers and technicians to understand how the basic test instruments work and how they can be used. The book covers analogue and digital meters, bridges, oscilloscopes, signal generators, counters, timers and frequency measurement. 203 pages.

B 2281 $19.95

Digital Electronics Project for Beginners



- For newcomers to electronics construction
- Simple self build projects
- Gives full constructional details
- Learn about digital electronics as you build

This book contains 12 digital electronics projects suitable for the beginner to build with the minimum of equipment. They cover a wide range of topics, from instrumentation to home security, and a few 'fun' projects as well. With one exception, all the projects are battery-powered, so are completely safe for the beginner.

Each project has a circuit diagram, a drawing of the stripboard layout, and full constructional details with instructions for testing the circuit at each stage.

B 2280 $13.95

PHONEORDER TOLL FREE 008 999 007

REFERENCE BOOKS

555 TIMER APPLICATIONS SOURCE BOOK WITH EXPERIMENTS

Describes the construction and use of various versions of the 555 timer and gives many practical applications.

B 2020 **$19.95**

IC OP-AMP COOKBOOK

(3rd Edition) Walter Jung

Hobbyists and design engineers will be especially pleased at this new edition of the industry reference standard on the practical use of IC OP AMPs. The third edition has been updated to include the latest IC devices, such as chopper stabilized, drift-trimmed BIFETS. The section on instrumentation amps reflects the most recent advances in the field. Jung is recognised as an expert in the fields of IC and audio OP AMPS. 600 Pages.

B 2015 **$49.95**

DESIGN OF OP-AMP CIRCUITS WITH EXPERIMENTS

An experimental approach to the understanding of OP-AMP CIRCUITS. Thirty-five experiments illustrate the design and operation of linear amplifiers, differentiators and converters, voltage and current converters, and active filters.

B 2017 **$29.95**

CMOS COOKBOOK

Don Lancaster

Handy but comprehensive reference for CMOS, the most popular and widely used digital logic family, not to mention the author's engaging writing style. Don't miss out on one of the most widely used electronics books published in the last ten years. 400 pages.

B 2010 **$38.95**

THE Z-80 COMPUTER HANDBOOK

Extensively covers all aspects of the Z-80 including hardware, interface signals, timing, addressing modes and instructions, arithmetic operations and other operations on CPU flags, interrupt sequences and interfacing examples of I/O on memory devices. Subjects also addressed are machine language, programming operations and other microcomputers built around the Z-80. 304 pages.

B 2085 **$39.95**

Z-80 DESIGN PROJECTS

Includes a variety of peripheral circuits designed to interface with the famous Z-80 microcomputer. Perfect addition to the above Z-80 handbook.

B 2080 **$39.95**

ELECTRONIC TELEPHONE PROJECTS

Perform fifteen fascinating telephone projects with the help of this book. Through building, testing and connecting these projects, you will gain an understanding of basic telephone principles.

B 2150 **$24.95**

REGULATED POWER SUPPLIES

(3rd Edition)

Improved performance and greater reliability are the result when you use regulated power supplies. Learn about static characteristics, dynamic characteristics, regulation techniques, and linear and switching-type regulators using integrated circuits. 424 pages.

B 2160 **$44.95**

SEMI CONDUCTOR GENERAL PURPOSE REPLACEMENTS

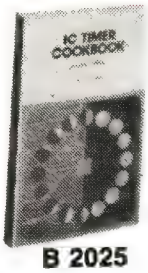
(4th Edition)

Shows general-purpose replacements for almost 225,000 bipolar and field effect transistors, diodes, rectifiers, IC's & more listed by U.S. and foreign type numbers, manufacturer's part number or other I.D. Easy to use and complete. 960 pages.

B 2030 **$34.95**

IC TIMER COOKBOOK

(2nd Edition)



You can learn lots of ways to use the IC timer in this easy-to-use second edition which includes many new IC devices. Ready to use applications are presented in practical working circuits. All circuits & components relationships are clearly defined and documented. 394 pages.

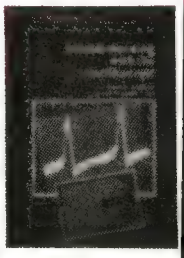
B 2025 **$41.95**

HOW TO BUILD SPEAKER ENCLOSURES

A practical guide to the whys and hows of constructing high quality, top performance speaker enclosures. A wooden box alone is not a speaker enclosure - size, baffling, sound insulation, speaker characteristics, & crossover points must all be carefully considered. 144 pages.

B 2155 **$17.95**

TROUBLESHOOTING WITH THE OSCILLOSCOPE



(Fifth Edition)

Topics covered include:- Introduction to the Oscilloscope. How to operate an Oscilloscope. Using Oscilloscope Probes. TV signal tracing in RF, IF & Video Amplifiers. Signal Tracing the TV Sync section. Wave-form tests in the Horizonta sweep section. Troubleshooting in the TV Vertical sweep section. Signal Tracing in the TV Sound-IF and audio. Special Oscillo scopes and their applications. Digital logic troubleshooting with the Oscilloscope. 256 pages.

B 2120 **$39.95**

ELECTRONICS AND MUSIC

COMPUTERS & MUSIC

● Explains the basics of computing ● No previous computer knowledge needed ● Covers types of music software available ● Explains how to set up your own computer music studio ● Glossary of terms. If you're more used to the black and white keys of a keyboard than the QWERTY keyboard of a computer, yo may be understandably confused by the ja gon and terminology bandied about by com puter buffs. But fear not, setting up and usin a computer based music making system is n as difficult as you might think. 176 pages.

B 2210 **$17.95**

PRACTICAL MIDI HANDBOOK

● For musicians, electronics enthusiasts, students, technicians ● Full explanation of MIDI modes and channels ● Real time and step time sequencing ● Tables of MIDI codes and reference data ● Glossary of terms. The majori of the book is devoted to an explanation what MIDI can do and how to exploit it to th full with practical advice on connecting up MIDI system and getting it to work, as well a deciphering the technical information in thos equipment manuals. "Can be recommended - Home & Studio Recording. "Excellent bac ground reading." - Yamaha XPress. "Provid a good basic knowledge of MIDI." - E *"Excellently informative book."* - Practic Electronics. 160 Pages.

B 2220 **$15.00**

PHONEORDER TOLL FREE 008 999 007

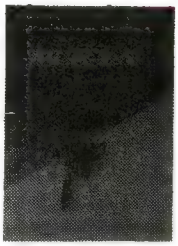
TALKING ELECTRONICS PUBLICATIONS

Great Booklets for Schools!

BUGGING - AND ITS PREVENTION

From Talking Electronics

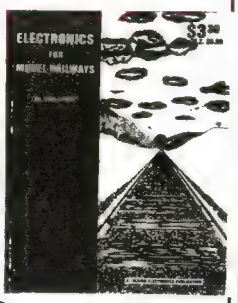
The third book on bugging and security from the popular Talking Electronics team. Contains many handy projects & relevant articles, including a complete list of surveillance devices. 74 pages.



B 1532 $3.35

ELECTRONICS FOR MODEL RAILWAYS

Details on scale fluro lamps, air horn, pedestrian light chasers, level crossings, throttle control, rotating light, boom control, remote relay.



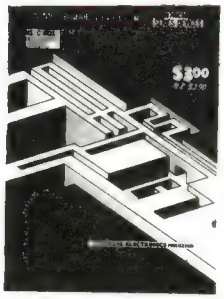
B 1525 $3.30

SECURITY DEVICES

Projects include a spy bug, field strength meter, FM radio, 10 minute timer, light alarm, phone alert, motor speed controller, pen bug.

B 1539 $3.40

CMOS B-SERIES DATABOOK



Gives details on COS/MOS B-Series devices, 4000 Series and 74HCOO Series.

B 1530

$3.00

STARTING IN TTL

Basic theory on the buffer, inverter, and "And" gate, "Nand" gate, "Or" gate, "Nor" gate, flip-flops, building the trainer. Good solid basic theory. Easy to read.

B 1535

$3.50

TALKING ELECTRONICS 14

Build a continuity tester, crystal oscillator, guitar practice amp. Transistor theory.

B 1536

$2.20

TALKING ELECTRONICS 15

Build a car alarm, a 32 key organ, TEC comp., speech module, liquid crystal display, FM radio using the TDA 7000.

B 1537

$3.00

DIGITAL LOGIC GATES AND FLIP-FLOPS

What they do and how to use them.

● For electronics technicians, students and enthusiasts ● Thorough treatment of gates and flip-flop ● An aid to the design and troubleshooting of digital circuits ● Only a basic knowledge of electronics required. This book seeks to establish a firm foundation in digital electronics by treating the topics of gates and flip - flops thoroughly and from the beginning. It is for the user who wants to design and troubleshoot digital circuitry with considerably more understanding of principles than the constructor, and who wants to know more than a few rules of thumb about digital circuits. Topics such as Boolean algebra & Karnaugh mapping are explained, demonstrated and used extensively. The book concludes with an explanation of microprocessor techniques as applied to digital logic. 204 Pages

B 2250 $19.95

PRACTICAL DIGITAL ELECTRONICS HANDBOOK

B 2260

$17.50

● For enthusiasts, technicians and students ● Nine digital test gear projects ● CMOS and TTL pinouts ● Tables of reference data. The book introduces digital circuits, logic gates, bistables and timers, as well as microprocessors, memory and input/output devices, before looking at the RS-232C interface and the IEEE-488 and IEEE-1000 microprocessor buses. Nine constructional projects form a major feature of the book, and the practical emphasis is continued with appendices on test equipment and useful reference data. "A very useful book" - Elektor. "A useful low cost guide" - Radio & Electronics World. 208 Pages

PHONEORDER TOLL FREE 008 999 007

DATA MANUALS

BUY SEPARATELY OR BUY THE SET

BUY THESE 15 MOTOROLA TITLES AS A SET AND
SAVE $30.00 ONLY $300.00 A SET

BUY THESE SIX TEXAS INSTRUMENT TITLES AS A SET AND
SAVE $11.25
ONLY $100.00 A SET

MOTOROLA MECL DATA
Emitter Collector Logic (ECL) is today's fastest form of digital logic providing the most direct way of improving system performance. Provides data on the 10KH, 10K and 111 families. MECL memory and PLL chips.

B 1100 $13.50

MOTOROLA POWER DATA
Book includes a 9 page selection guide, application notes and data sheets for over 700 devices. 989 pages.

B 1101 $25.95

TMOS DATA
This manual is intended to give the users of Power Mosfets basic information on the products, application ideas and data sheets of the broadest line of Mosfets. With over 225 device types in 11 package configurations currently available from Motorola.

B 1102 $12.95

MOTOROLA MASTER SELECTION GUIDE
The most useful book ever printed covers MOS IC's listed by function LINEAR IC's listed by function INTERFACE IC's listed by function. LS1 memory, TTL, ECL, power products, SCR's, diodes, transistors listed by application and ratings. Essential data given for all devices. Terrific Value.

B 1104 $24.50

MOTOROLA CMOS DATA
A comprehensive reference covering 40XX. 45XX CMOS families along with speciality devices such as LCD drivers, telephone & general communications functions and industrial control. 862 pages essential in all spheres of electronics.

B 1105 $17.95

MOTOROLA CMOS SPECIAL FUNCTIONS DATA
This book presents technical data for the CMOS and NMOS Special Function integrated circuits. Complete specifications are provided in the form of data sheets. In addition, a Function Selector Guide and a Handling Precautions chapter have been included to familiarize the user with these circuits.

B 1106 $14.25

SCHOTTKY TTL DATA
Essential reference for the enthusiast and engineer alike. Designing, building and servicing digital circuitry is an absorbing pastime. Data for the LS, ALS and FAST families along with design considerations and circuit characteristics are logically presented in this manual, making it quick and easy to use.

B 1109 $24.50

MOTOROLA MEMORY
An absolute must for the microprocessor buff. This is the latest reprint of Motorola's famous memory data manual and includes the latest specifications and design application data on TTL RAM, TTL PROM. MECL MEMORY, MECL RAM. MECL PROM. MOS DYNAMIC RAM. MOS STATIC RAM. MOS EPROM. MOS EE PROM AND MOS ROM. Worth many dollars more.

B 1113 $19.95

LINEAR & INTERFACE DATA
Includes Data design procedures and equivalent listings for 1000's of devices under headings OP AMPS. VOLTAGE REGULATORS CONSUMER CIRCUITS (e.g. TV Automotive power). HIGH FREQUENCY CIRCUITS & SPECIAL PURPOSE CIRCUITS.

B 1114 $45.50

MOTOROLA TELECOM DEVICES DATA
This data book pulls together Motorola's products dedicated to telecommunications. An essential reference for the designer of telecommunications equipment.

B 1115 $19.95

MOTOROLA RF DATA & APPLICATIONS
The Third Edition of the RF Data Manual has been updated to incorporate the latest changes since the last printing. There are over 500 devices, 19 application notes, and 22 engineering bulletins which cover RF Power and Small Amplifiers and Tuning Diodes.

B 1117 $41.95

MOTOROLA OPTO ELECTRONIC DATA
Motorola has concentrated on infra-red GaAs and GaA/As emitters, silicon detectors high-technology optocouple isolators and an innovative approach to Fibre Optic components. This Opto-electronic Data Book contains upto-date specifications on the complete product line. The catalogue is divided into chapters covering general information,selector guide/ cross-reference, reliability and applications for each product segment.

B 1119 $15.50

MOTOROLA 74HC DATA BOOK
This book presents technical data for the broad line of High-Speed Logic integrated circuits. Complete specifications are provided in the form of data sheets. In addition, a comprehensive Function Selector Guide and a Design Consideration chapter have been included to familiarize the user with these new logic circuits. Includes 74HC Series IC's.

B 1121 $16.50

MOTOROLA 8 BIT MICROPROCESSORS AND PERIPHERALS
This manual covers all aspects of Motorola's microprocessor, microcomputer and peripheral components. A clearly written manual providing all the data necessary to design and build a working computer system from scratch. 100's of circuit examples, flow charts, truth tables and programme routines.

B 1125 $28.00

T.I. POWER DATA
The Power Products Data Book from Texas Instruments contains technical information on discrete power semiconductors. The product line includes a wide selection of standard transistors, Triacs, SCRs, Darlingtons, and Advanced Planar transistors - "Workhorse" components that have proved their value in hundreds of applications around the world.

B 1202 $22.95

T.I. INSTRUMENTS LINEAR APPLICATIONS
This series of volumes covers linear and interface circuits applications:-

Volume 1: Covers Amplifiers, comparators, timers, and voltage regulators

B 1206 $12.75

Volume 2: Looks at Line Circuits and Display Drivers

B 1208 $12.75

Volume 3: The 3rd Volume in the series covers Peripheral Drivers, Data Acquisition systems, Hall effect Devices.

B 1210 $12.75

TEXAS INSTRUMENTS LINEAR CIRCUIT DATA
The rapid advance in high-tech digital processing creates new demands for microprocessor compatible circuits that can sense, amplifier, and convert analog signals or provide regulated power to a system. In this volume, Texas Instruments presents specifications and technical information on our broad line of integrated circuits designed for applications that involve analog signal conditioning. That product line includes:-

- Operational amplifiers
- Voltage comparators
- Regulators
- Power supply monitors
- Switching-mode power supply circuits
- Hall-effect circuits
- Current mirrors
- Floppy-disk circuits for control, reading & writing
- Timers
- A/D converters
- Video amplifiers
- Analog switches

B 1214 3 Volumes
$42.45

T.I. MOS MEMORY DATA BOOK
Commercial and Military Specifications. This Data Book contains data on DRAM, EPROM, PROM, EEPROMS, VLSI MEMORY management products. Includes SMJ, SN, TACT, THCT, & T SERIES.

B 1216 $31.55

PHONEORDER TOLL FREE 008 999 007

DIN CONNECTORS

tes — The numbering of the contacts is shown as seen on the mating face of the connector.

Notes 2 — The same connectors are used for monaural and stereophonic systems.

Notes 3 — Normally, it is recommended to connect the shell of the plug to terminal 2 of the connector to ensure that the screen is earthed.

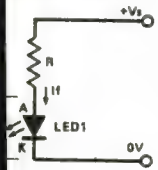
ABLE 1

tact arrangement See Note 1	IEC Type designation/ * Pin connector	Socket connector	Application		Connections 1	2	3	4	5
	01	02	Microphone	Monaural system (balanced)	Hot lead	Screening; earth See Note 3	Return lead		
				Monaural system (unbalanced)	Hot lead				
MALE PLUG	03	04	Microphone	Stereophonic system (balanced)	Hot lead of left-hand channel		Return lead of left-hand channel	Hot lead of right-hand channel	Return lead of right-hand channel
				Stereophonic system (unbalanced)	Hot lead of left-hand channel			Hot lead of right-hand channel	
FEMALE SOCKET			Record player	Monaural system			Hot lead		Connected to 3
			See Note 2	Stereophonic system			Hot lead of left-hand channel		Hot lead of right-hand channel
			Tape recorder	Monaural system	Input signal		Output signal	Connected to 1	Connected to 3
			See Note 2	Stereophonic system	Input signal of left-hand channel		Output signal of left-hand channel	Input signal of right-hand channel	Output signal of right-hand channel

LEDS

OUR	RED	ORANGE	YELLOW	GREEN
CAL)	1.8V	2.0V	2.1V	2.2V

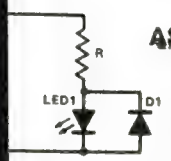
BLE 1 Typical forward age characteristics of stan- d LEDs with forward current at 20 mA.



OPERATING LED FROM DCV

$$R = \frac{V_s - V_f}{1f}$$

OPERATING LED FROM ACV AS AN INDICATOR

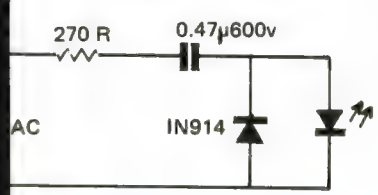


$$R = \frac{0.5\ (V_s - V_f)}{1f}$$

IN914

bove formulas should be used junction with Table 1 to deter- he required series resistance to te LEDS at 20mA.

ERATING DIRECTLY FROM 240V AC MAINS



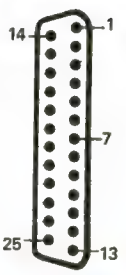
bove circuit results in a LED nt of approximately 16mA.

COMPUTING TERMS

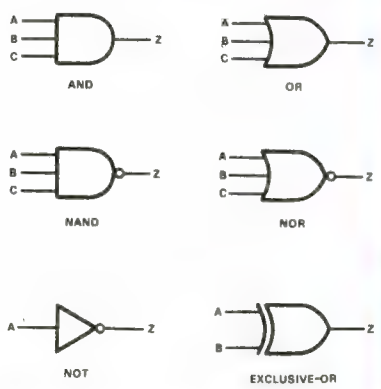
ASM: Assembler.
BASIC: Beginners All-purpose Symbolic Instruction Code.
BDOS: Basic Disk Operating System.
BIOS: Basic Input/Output System.
Bit: Binary Digit. Either 1 or 0.
Bug: an error in a program.
Byte: A computer word eight bits wide.
CBASIC: A commercial version of the BASIC language, running under CP/M.
CCP: Console Command Processor.
Chain: To automatically run one program after another.
CRT: Cathode Ray Tube.
DDT: Dynamic Debug Tool.
Editor: A program which lets you alter and correct source files and other documents.
FIFO: First in, first out.
Iff: If and only if.
I/O: Input/Output.
Kilobyte: 1024 bytes (Kbyte).
Kilobaud: 1000 baud (kbaud).
Macro: A user-defined sequence of instructions which can be inserted anywhere in a program.
MBASIC: Microsoft BASIC.
NAD: A name and address file maintenance program.
Page: A length of memory, typically 256 bytes.
Parity: An extra bit on the end of a character or byte for error detection.
PIP: Peripheral Interchange Program.
Poll: To ask a peripheral if it requires service.
R/O: Read Only; cannot be overwritten.
RAM: Random Access Memory.
RPN: Reverse Polish Notation.
TTY: Teletype.

RS232C CABLE PLUG CONNECTIONS

PIN NO.	SIGNAL
2	TRANSMIT DATA
3	RECEIVED DATA
7	SIGNAL GROUND
4	RTS
5	CTS
8	RLSD
6	DSR
20	DTR



BASIC LOGIC FUNCTIONS



STANDARD CENTRONICS PRINTER PLUG CONNECTIONS

PIN NO.	SIGNAL
19	SIGNAL GROUND
2	DATA BIT 0
3	DATA BIT 1
5	DATA BIT 2
5	DATA BIT 3
6	DATA BIT 4
7	DATA BIT 5
8	DATA BIT 6
1	DATA STROBE
10	DATA ACKNOWLEDGE
11	INPUT BUSY READY

PHONEORDER TOLL FREE 008 999 007

DATA

RESISTORS

They are generally small cylindrical devices between 5 and 40mm long. They are recognized by coloured rings around them.

Large wattage types are generally rectangular and have their values written on them.

Resistance is measured in ohms, which is abbreviated to Ohm or R. Thousands of ohms is abbreviated to K and millions of ohms to M.
Eg. 10,000 ohm is 10K
15,000 ohm is 15M

The coloured rings around a resistor determine its value. The first three indicate its resistance, and the fourth its tolerance.

Tolerance is how much it varies from its specified value. This is given as a percentage.

Eg. 5% tolerance. The fourth band is Gold. A 100 Ohm 5% tolerance resistor could be anywhere between 95-105 ohm.

Circuits generally take this into account.

To determine resistor value, the first two rings are the significant value, the third ring is the number of zeros following:-

Examples:-

68 ohms, 5% .... Blue, Grey, Black, Gold
1K ohm, 5%.... Brown, Black, Red, Gold
560K ohm, 5% Green, Blue, Yellow, Gold
47K ohm, 2% Yellow, Violet, Orange, Red

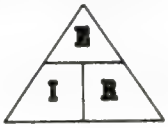
Ohm's Law

The relationship between resistance, voltage and current is defined by Ohm's Law
The formulas are:-

$E = I \times R$
$I = E/R$
$R = E/I$

Where
E= Volts
R= Resistance in Ohms
I=Current in Amps

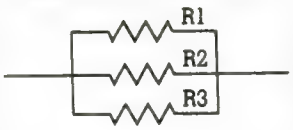
An easier way to remember Ohms Law is by this diagram. Just cover up the value you are looking for, and the formula shows.



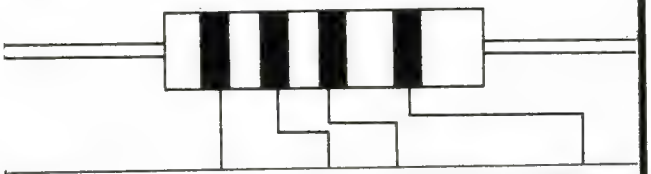
Resistors in series

R TOTAL=R1+R2+R3

Resistors in parallel



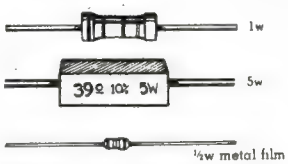
$$R\ TOTAL = \frac{1}{\frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}}$$



COLOUR	TENS	UNITS	MULTIPLIER	TOLERANCE
Black	0	0	1	20% (M)
Brown	1	1	10	1% (F)
Red	2	2	100	2% (G)
Orange	3	3	1000	–
Yellow	4	4	10000	–
Green	5	5	100000	–
Blue	6	6	1000000	–
Violet	7	7	–	–
Grey	8	8	–	–
White	9	9	–	–
Gold	–	–	0.1	5% (J)
Silver	–	–	0.01	10% (K)

Close Tolerance Resistors

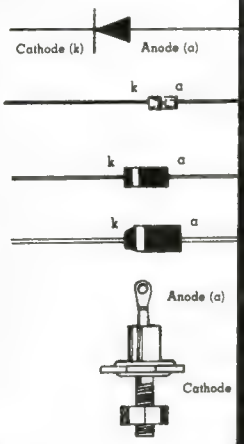
1% resistors have five coloured bands instead of four. The colour coding is basically the same except that they have three bands indicating the significant values, the fourth band is the multiplier and the fifth is the tolerance



Resistors shown approximate actual size

Diodes

Diodes are used to rectify current, and detect signals. They are generally ra terms of voltage and current.
Most diodes are about 3-10mm long cylindrical. They may be black or cl
Diodes are always polarised. The po cathode is marked with a black or si stripe. You can check whether or not a destroyed by measuring its resistance ohmmeter. If the diode is OK, it will extremely high resistance in one direc a low resistance in the other directio testing, don't touch the leads with your This will give misleading readings



Shell sizes
Actual size reproductions

'D' type subminiature shell sizes. You can work panel cutouts from this information.
(They are actual size).

1.239" x .515" overall
(31.47 x 13.08)

2.107" x .515"
(53.57 x 13.08)

2.661" x .626"
(67.59 x 15.90)

1.567" x .515"
(39.80 x 13.08)

2.754" x .515"
(96.95 x 13.08)

PHONEORDER TOLL FREE 008 999 007

CAPACITORS

Capacitors store electrical charge, and can transmit alternating current, although they can't pass a direct current.

Capacitor markings puzzle amateurs and professionals alike. There are many different codes.

The most common types are Greencaps, ceramics, styroseal, electrolytic and tantalum.

Electrolytic and tantalum capacitors are polarised. This means that they have a positive and a negative lead and must be installed the correct way round.

Capacitance is measured in Farads. A Farad is very large, and in most cases the units used are fractions of a Farad.

Microfarad (uF) ....a millionth of a farad
Nanofarad (nF) .....a thousandth of a microfarad
Picofarad (pF) .....a thousandth of a nanofarad
So .001uF = 1nF = 1,000pF

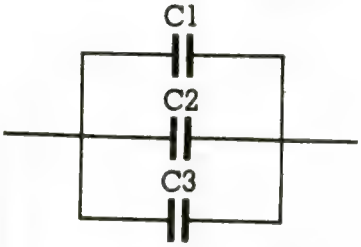
CAPACITOR MAGNITUDES

100,000 pF = 0.1uF or 100nF
10,000 pF = 0.01uF or 10nF
1,000 pF = 0.001uF or 1nF
100 pF = as is (100pF)
10 pF = as is (10pF)
1 pF = as is (1pF)

CAPACITORS IN SERIES

$$C\ TOTAL = \frac{1}{\frac{1}{C1} + \frac{1}{C2} + \frac{1}{C3}}$$

CAPACITORS IN PARALLEL

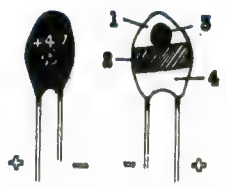


C TOTAL=C1+C2+C3

TANTALUMS

These are generally marked in uF, with the voltage and polarity clearly marked.

Some only have a colour code and a dot on them. Looking at the capacitor with the dot towards you and the leads down, the positive is the lead on the right hand side.



TANTALUM CAPACITOR COLOUR CODE

Colour	1	2	3	4
Black	–	0	x1μF	10V
Brown	1	1	x10μF	–
Red	2	2	x100μF	–
Orange	3	3	–	–
Yellow	4	4	–	6.3V
Green	5	5	–	16V
Blue	6	6	–	20V
Violet	7	7	–	–
Grey	8	8	x0.01μF	25V
White	9	9	x0.1μF	3V
Pink	–	–	–	35V

GREENCAPS

Greencaps can be marked in a number of different ways. Generally the value is marked in uF:- .001/100. The 100 represents the maximum voltage the capacitor can work at.

The IEC capacitor code is often used. An example would be:- 123K

The first two numbers are the significant figures, and the third the number of zeroes following. The value so derived is in pF. The letter (K in this case) indicates the tolerance.

M = 20% tolerance
K = 10% tolerance
I = 5% tolerance

So a 153K is a 15,000pF or 15nF or 0.015uF, 10% tolerane greencap. Larger value greencaps are usually marked in Microfarads:- e.g. 0.01uF.

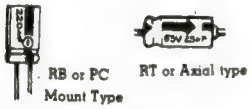
Greencaps are also available in some values at voltage ratings up to 630VDC.

ELECTROLYTICS

Most Electros' have their capacitance and voltage rating marked on them. Electros are always marked in uF. Tolerance is not usually marked, but it can vary greatly. A 100uF capacitor could well be anywhere between 80uF and 150uF. Circuits take this into account.

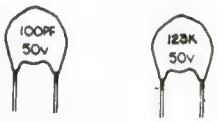
The *negative* symbol is generally marked.

Electros must be put in ciruit the right way round.



CERAMICS

Small ceramics are marked in pF (picofarads) Eg. 1pF to 820pF. Above that they usually revert back to uF. Remember that 1000pF equals 0.001uF. Ceramic capacitors used in kits are usually rated at 50V dc.



STYROSEALS

These capacitors are marked thus:- 47/630. The first figure is the value in pF and the second is the DC working voltage. Thus a styroseal marked in this way would be 47pF and 630V DC working voltage.

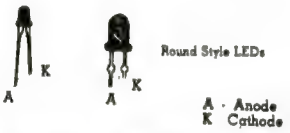
Styroseals are not polarized and so may be inserted in circuit either way round.

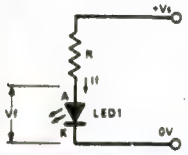
LED's

Light Emitting Diodes are a special type of diode which lights up when a voltage is applied. They are available in red, green, yellow, orange and in various sizes and shapes. LEDs are polarized, and can be damaged by reverse connection. As a general rule, the longer lead is the positive.

COLOUR	RED	ORANGE	YELLOW	GREEN
VF (TYPICAL)	1.8V	2.0V	2.1V	2.2V

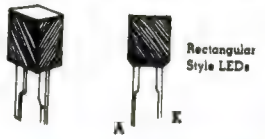
TABLE 1 Typical forward voltage characteristics of standard LEDs with forward current set at 20 mA.





OPERATING LED FROM DCV

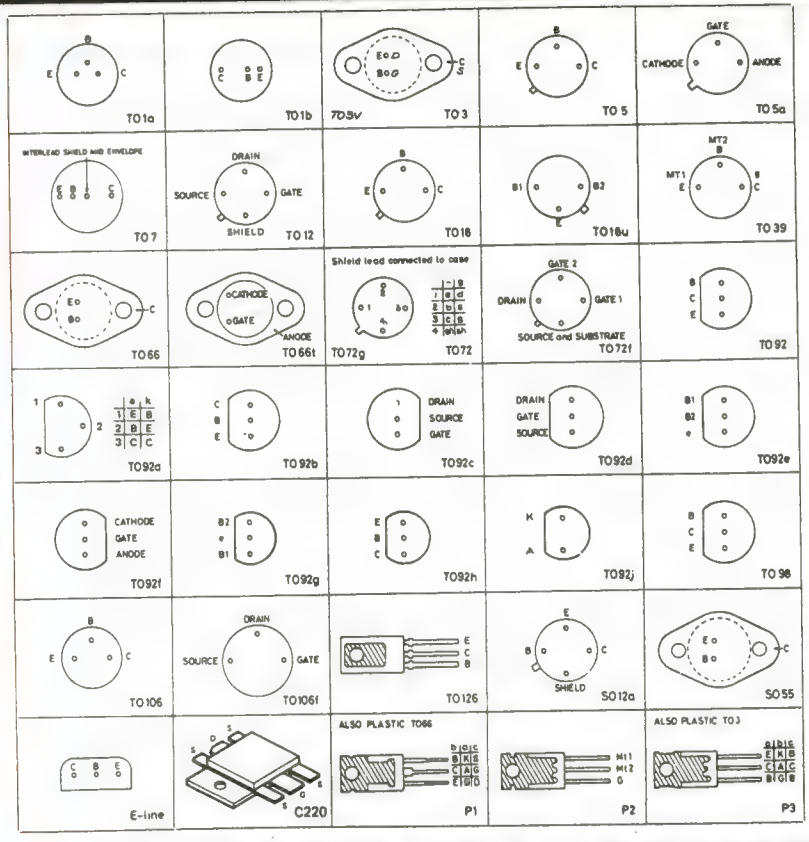
$$R = \frac{Vs - Vf}{If}$$



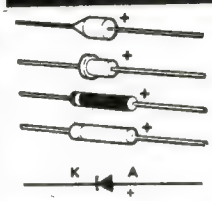
PHONEORDER TOLL FREE 008 999 007

DATA

TRANSISTOR PINOUTS (All viewed from below)



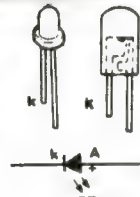
MORE PINOUTS



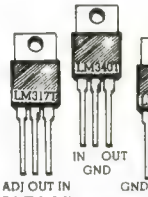
Diodes and Zener diodes

Positive
5V 7805 orLM340T5
12V 7812 or LM340T12
15V 7815 or LM340T15
Negative
5V 7905 or LM320T5
12V 7912 or LM320T12
15V 7915 or LM320T-15

LM317K is a vanable 1A regulator 2-30V

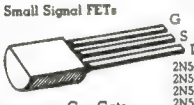


LEDs



VOLTAGE REGULAT

Small Signal FETs



G - Gate
S - Source
D - Drain

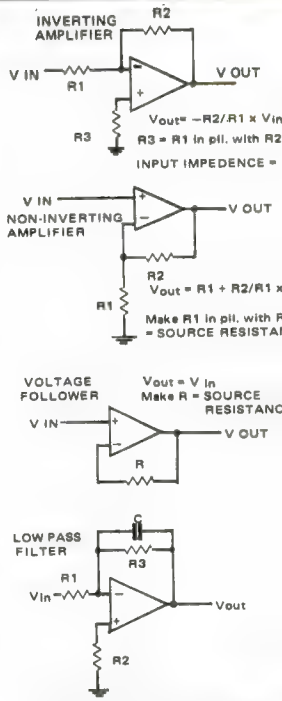
2N5457
2N5458
2N5459
2N5484
2N5485
MPF106

Tantalum capac

Programmable Unijunction Transistor (PUT)
2N6027/D13T1

Viewed from b

STANDARD OP AMP CONFIGURATIONS



ELECTRICAL FORMULAE

OHM'S LAW The relationship between resistance, voltage and current is defined by Ohm's Law. The formulas are:-

$E = I \times R$
$I = E/R$
$R = E/I$

Where
E=Volts
R=Resistance in Ohms
I=Current in Amps

Series and Parallel Connections

Resistors in series

$$R_{total} = R1 + R2 + R3 + \ldots$$

Resistors in parallel

$$R_{total} = \frac{1}{1/R1 + 1/R2 + 1/R3 \ldots\ldots}$$

Capacitors in series

$$\frac{1}{C_{total}} = \frac{1}{C1} + \frac{1}{C2} + \frac{1}{C3} + \ldots$$

Capacitors in parallel

$$C_{total} = C1 + C2 + C3 + \ldots$$

POWER IN A CIRCUIT

The relationship between current flowing through a given resistance at any voltage is defined by -

$P = E \times I$
$E = P / I$
$I = P / E$

where E = volts
P = power
I = current

ZENER DATA

VOLTAGE	400mW TYPES*	1 W TYPES**
3.3	IN746	
3.6	IN747	
3.9	IN748	
4.3	IN749	
4.7	IN750	IN4732
5.1	IN751	IN4733
5.6	IN752	IN4734
6.2	IN753	IN4735
6.8	IN754,IN957	IN4736
7.5	IN755,IN958	IN4737
8.2	IN756,IN959	IN4738
9.1	IN757,IN960	IN4739
10	IN758,IN961	IN4740
11	IN962	IN4741
12	IN759,IN963	IN4742
13	IN964	IN4743
15	IN965	IN4744
16	IN966	IN4745
18	IN4112	IN4746
20	IN968	IN4747
22	IN969	IN4748
24	IN970	IN4749
27	IN971	IN4750
30	IN972	IN4751
33	IN973	IN4752

* Dissip. 400mW, Op Temp 50°C, Case DO-7 or DO-35
** Dissip 1W, Op Temp 50°C, Case DO-41. This range will dissipate up to 3 watts @ 75°C with 10mm lead length as heatsink

AVERAGE, RMS, PEAK, AND PEAK-TO-PEAK VALUES FOR A SINE WAVE

Given Value	Multiplying Factor to Get			
	Average	RMS	Peak	Peak-to-Peak
Average	–	1.11	1.57	3.14
Rms	0.9	–	1.414	2.828
Peak	0.637	0.707	–	2.0
Peak-to-Peak	0.32	0.3535	0.5	–

SUFFIXES 'k', 'm', 'M' etc after component values indicate a numerical multiplier or divider – thus

Multipliers	Dividers
k = X 1000	u = ÷ 1000 000
M = X 1000 000	n = ÷ 1000 000 0
G = X 1000 000 000	p = ÷ 1000 000 0

PHONEORDER TOLL FREE 008 999 007

Reactance-Frequency Chart For Capacitors Inductors & Tuned Circuits

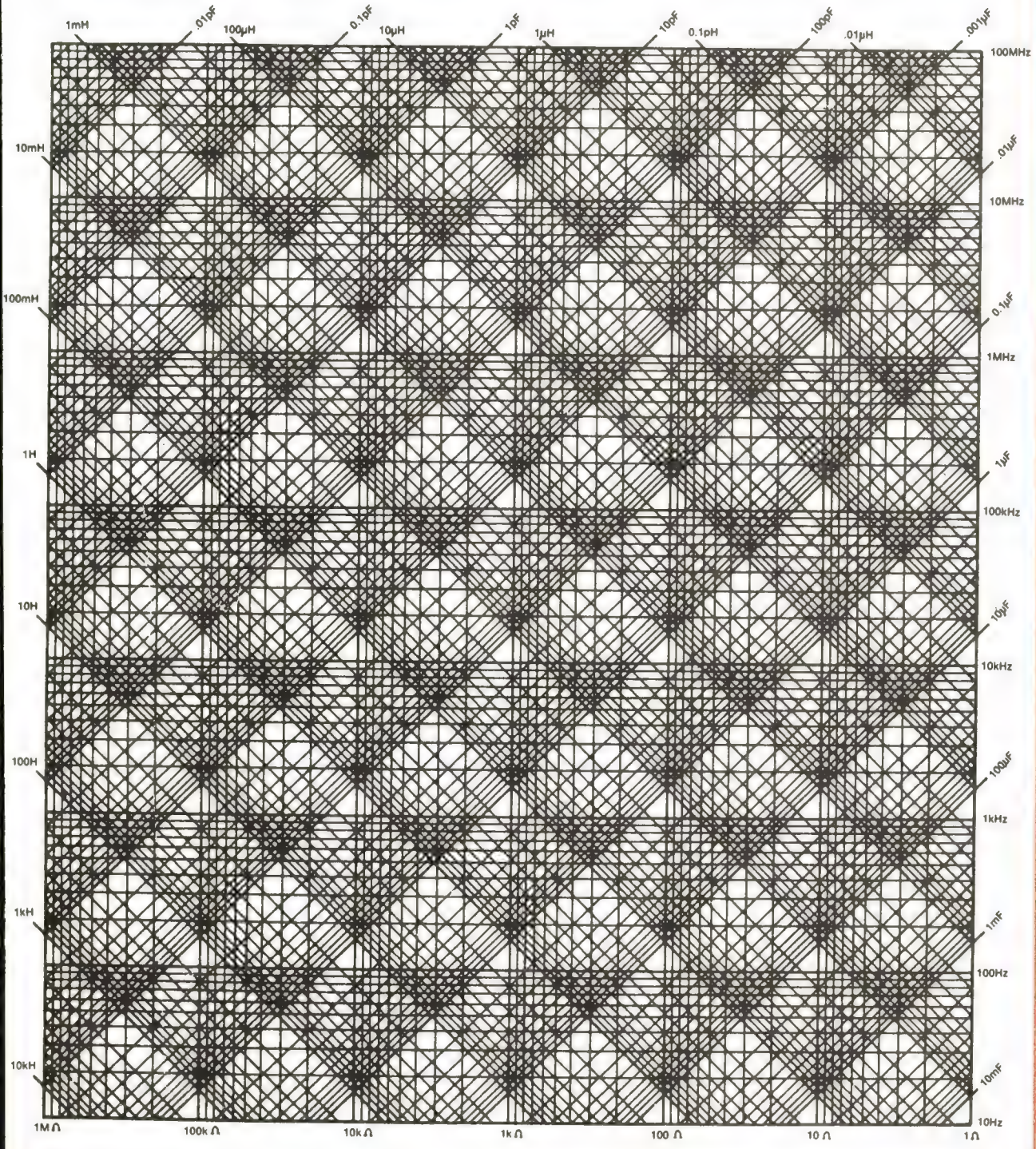
This chart can save a great deal of time when selecting values for coupling and bypassing capacitors, etc. Using it you can frequently avoid tedious calculations.

To find the reactance of a capacitor at a given frequency, follow the 45° capacitance value line until it intersects the horizontal frequency line, then read downwards to the ohms scale at the bottom. The reactance of an inductor can be read in a similar manner.

The chart can also provide information about resonant circuits. For example, locate where particular values of L & C intersect and read off the resonant frequency. If frequency is known and either L or C, find the intersect and read off the remaining value. Again, by following along a particular frequency line, a variety of LC options for resonance can be determined.

To design simple 6dB/octave speaker crossover networks, follow the appropriate resistance line up to where it intersects the desired crossover frequency and read off the required values of L & C.

Interpolate for values between the lines, using a needle point for increased accuracy.



Reproduced by kind permission of Electronics Australia

PHONEORDER TOLL FREE 008 999 007

ORDERING

TOLL FREE ORDER LINE 008 999 007

4 EASY WAYS TO ORDER

Toll Free Phone Order
Bankcard, Visa, Mastercard

Just phone your order Toll Free on - 008 999 007 till 6:00pm Eastern Standard Time (4:00pm Western Time).
This line is reserved for retail customers only. For Wholesale and Technical enquiries, please phone - 09 328 2199.

Via Mail

Post to: Altronics Mail Order,
P.O. Box 8350
Perth Stirling Street
Western Australia 6849

Perth Shop Address

174 Roe Street, Perth W.A. 6000
Phone: (09) 328 1599

Shop Hours

8:30am - 5:15pm	Monday to Friday
8:30am - 8:00pm	Thursday
8:30am - 12:00 noon	Saturday

Via Telex

AA 94186 Altron

Via Fax

(09) 328 4459

Personal Shoppers

We pride ourselves with the standard of service we offer you, the electronic enthusiast and the general electronics buying public. Altronics staff are all technically competent and will be only too pleased to assist with your enquiries.

ALTRONICS DELIVERY SERVICE CHARGES

Please Nominate Desired Service & Include Delivery Charges with your Order

Mail

$5.50 to 1Kg **$8.00** over 1Kg Max 5Kg. Allow approximately 7 days from date of posting order to receipt of your goods.

Overnight Jetservice

$10.00 to 3Kg **$28.00** to 5Kg Max. Delivery next day Capital Cities & Suburbs. Allow additional 24-48 hours for Country areas.

Road Express Heavy Service

$12.00 to 10 Kg **$15.00** over 10Kg
All orders 10Kg or more must travel road express. Allow approximately 7 days for receipt of your order.

Insurance is available at the rate of $1 per $100 or part thereof (min charge is $1).
We can only accept claims for damage or loss etc. where the consignment is insured.

GENERAL ORDER INFORMATION

14 Day Satisfaction Guarantee

If you are dissatisfied with our goods and services for any reason, please return to our premises within 14 days of our despatch date and we will refund your purchase in full, less transport costs. All returned goods must be in as sold condition and include all packaging instructions, invoices etc.

Sales Tax

All prices in this catalogue include Sales Tax. Tax free sales can be made: (a) Where offical Sales Tax exemption is supplied. (b) Where each item on the order is not less than $10.00 and the overall value is not less than $20.00. Our staff will simply deduct Sales Tax where possible.

Complaints

At Altronics we take great pride in the goods and service we offer. If you have any constructive comments or complaints please phone:
JACK O'DONNELL
(09) 328 2199
or write:
C/- Altronic Distributors Pty. Ltd.
P.O. Box 8350
Perth Stirling Street
Western Australia 6849

Stock

Should any item ordered be temporarily unavailable, we automatically place this on back order. If this is inconvenient please advise upon receipt of partial shipment.

Warranties

3 months from date of supply. Faulty goods must be returned to our store with evidence of purchase and $4 money order, cheque or stamps to cover return postage.

Monthly Accounts

30 day mini convenience credit acounts are available to schools, universities, government institutions - sorry, we do not run acounts for private companies or individuals.

Delivery to Post Office Boxes

We can deliver to P.O. Boxes only where your full address is also supplied for our records. Jetservice or Road Express deliveries cannot be made to P.O. Boxes.

Minimum order

Altronics minimum is $10.00 exclusive of delivery charge.

Prices

Some prices may alter during the life of this catalogue. Circumstances such as exchange rates, sales tax & import duty can significantly influence prices and are regrettably beyond our control.

Strike Bound

Mail strikes don't worry us. Simply phone us up to 6:00pm EST, quote your credit card details and we deliver within two days via Jetservice.

Overseas Orders

The delivery rates quoted here apply to Australia only. Overseas orders are welcome - please send M.O. in A$ allowing sufficient air or sea postage.

New Zealand Customers

Your orders are very welcome. You may pay by Bankdraft, N.Z. bankcard or Visa. Please allow additional postage.

Papua New Guinea Customers

We accept Visa and Bankcard. Please allow additional Postage.

Damaged Goods

At Altronics we take great care in the protective packing of each consignment. In the unlikely event of your goods arriving damaged you must file a claim with the carrier concerned - do not open parcel if you suspect goods are damaged.

Insurance

Is available at the rate of $1 per $100 or part thereof (min charge is $1). Remember we can only accept claims for damage or loss etc. where the consignment is insured.

Resellers, Manufacturers, Bulk Users. Excellent discounts apply to resellers & bulk users. Please contact us at our Parent Company **Altronic Distributors** Phone: (09) 328 2199 Telex: 94186 Fax: (09) 328 4459

PHONEORDER TOLL FREE 008 999 007

ORDER FORM

MAIL TO **ALTRONICS MAIL ORDER**
P.O. BOX 8350, PERTH STIRLING STREET, WESTERN AUSTRALIA, 6849

(09) 328 1599 Order By Fax (09) 328 4459

TOLL FREE ORDER LINE
008 999 007

Name .....

Address .....

..... Postcode .....
We are unable to deliver to P.O. Boxes when using Jetservice or Road Express

Telephone No. .....

Date .....

Please note that manufacturing delays are beyond our control. Should we be unable to fill your order, we will place the items concerned on backorder and supply to you at the earliest date possible.

DELIVERY INSTRUCTIONS

- ❑ Standard Mail (Max. 1kg) **$5.50**
- ❑ Heavy Mail (1Kg to 5Kg) **$8.00**
- ❑ Overnight Jetservice **$10.00** to 3Kg **$28.00** to 5Kg Max.
- ❑ Road Express. Anywhere in Australia **$12.00** 5 to 10kg. - $15.00 10kg up.
  (All orders over 5kg must travel Road Express (allow 7-10 days)
- ❑ Transit Insurance (add **$1.00** per **$100** order value)
  (Australia Only)
- ❑ Overseas Air Freight (NZ/PNG) **$15.00** First kg.+ **$5.00 thereafter.**

MINIMUM ORDER AMOUNT $10.00 • 14 DAY MONEY-BACK GUARANTEE

Cat. No.	Description	Qty.	Item Price	Total Price	OFFICE USE ONLY

PAYMENT

❑ Cheque ❑ Money Order ❑ Bank Draft

VISA MasterCard **PAYMENT**

Card Expiry Date _____

Signature: _____

Merchandise Total:	
Pack & Delivery:	
Regist., Insurance:	
SUB TOTAL:	
TOTAL $	

Transit Insurance
Don't forget to nominate to protect you against loss or damage. Remember no loss or damage claims can be accepted unless insured

CHECK YOUR ORDER. IS YOUR NAME AND ADDRESS CLEAR?

Dear Customer — Please photocopy this form for your 1st order (or simply include the same details with your letter). A new Order Form is sent with each consignment.

TOLL FREE ORDER LINE 008 999 007

Altronics Resellers

Chances are there is an Altronics Reseller right near you — check this list or phone us for details of the nearest dealer.

Blue Ribbon Dealers are highlighted with a ■ These dealers generally carry a comprehensive range of Altronic products and kits or will order any required item for you.

Don't forget our Express Mail and Phone Order Service — for the cost of a local call, Bankcard, Visa or Mastercard holders can Phone Order for same day despatch.

Please Note: Resellers have to pay the cost of freight and insurance and therefore the prices charged by individual dealers may vary slightly from this Catalogue — in many cases, however, Dealer prices will still represent a significant cost saving from prices charged by Altronics Competitors.

ALBANY
BP Electronics■ ...(098) 412681
Micro Electronics.....(098) 412077
BUNBURY
Micro Electronics.....(097) 216222
ESPERANCE
Esperance Communications.(090) 713344
GERALDTON
Batavia Lighting & Electronics.....(099) 211278
KALGOORLIE
Todays Electronics■.....(090) 215212
MANDURAH
Micro Electronics.....(09) 5812206
PORT HEDLAND
Ivan Tomek Electronics.....(091) 732531
ROCKINGHAM
TV Joe's.....(09) 5271806

Force Electronics■.....(08) 2125505

BRIGHTON
Force Electronics■.....(08) 3770512
CHRISTIES BEACH
Force Electronics■.....(08) 3823366
ENFIELD
Force Electronics■.....(08) 3496340
FINDON
Force Electronics■.....(08) 3471188
LONSDALE
Force Electronics■.....(08) 3260901

MT.GAMBIER
South East Electronics.....(087) 250034
WHYALLA
Eyre Electronics.....(086) 454764

David Reid Electronics■.....(02) 2671385

CABRAMATTA
M & L Electronics.....(02) 7274431
CITY SOUTH
Sheridan Electronics.....(02) 2817727
SMITHFIELD
Chantronics.....(02) 6044595

COFFS HARBOUR
Coffs Habour Electronics.....(066) 525684
GRAFTON
East Coast Electronics.....(066) 431250
NEWCASTLE
Novocastrian Elect.Supplies .....(049) 621358
RAYMOND TERRACE
Alback Electronics.....(049) 873419
WAGGA WAGGA
PHILLIPS Electronics.....(069) 216558
WARNERS BAY
Vilec Distributors.....(049) 489405
WINDSOR
M & E Elect. and Communications.(045) 775935
WOLLONGONG
Newtek Electronics■.....(042) 271620
Vimcom Electronics.....(042) 284400

CANBERRA
Bennett Comm. Electronics.....(062) 805359

All Electronic Components.....(03) 6623506
The Electronic Component Shop■.....(03) 6706474

BORONIA
Ray Cross Electronics■.....(03) 7622422
CHELTENHAM
Talking Electronics.....(03) 5842386
CROYDON
Truscott Electronics■.....(03) 7233860
MOORABBIN
Talking Electronics Shop.....(03) 5320236
PRESTON
Preston Electronics■.....(03) 4840191

BAIRNSDALE
LH & LM Crawford.....(051) 525677
BALLARAT
Ballarat Electronics.....(053) 311947
BENDIGO
KC Johnson■ .....(054) 411411
MILDURA
McWilliam Electronics.....(050) 236410
WARRNAMBOOL
Koroit Electronics.....(055) 627417

HOBART
George Harvey■...(002) 342233
LAUNCESTON
George Harvey■...(003) 316533

Delsound PL■.....(07) 8396155

CAPALABA
Kingsway Electronics.....(07) 3902399
NEWSTEAD
ECQ Electronics.....(07) 2541153
WEST END
B.A.S. Audiotronics.....(07) 8447566
WOODRIDGE
David Hall Electronics■.....(07) 8082777

BUNDABERG
Bob Elkins Electronics.....(071) 721785
GLADSTONE
Supertronics.....(079) 724459
MACKAY
Philtronics■ .....(079) 578855
MAROOCHYDORE
MALS Electronics■.....(071) 436119
MARYBOROUGH
Keller Electronics.....(071) 214559
PIALBA
Keller Electronics.....(071) 283749
ROCKHAMPTON
Access Electronics (East St.).....(079) 221058
TOWNSVILLE
Super Solex■.....(077) 724466

ALICE SPRINGS
Farmer Electronics.....(089) 522388
DARWIN
Ventronics .....(089) 853622

If you have a Retail Shop, you could increase your income significantly by becoming an Altronics Dealer. Phone Brian Sorensen (09) 328 2199 for Details.

PHONEORDER TOLL FREE 008 999 007

Adaptor Plugs 81, 82
Adaptors, Power 81
Aerials - Car Radio 46
CB 46
TV 55
Alarms & Accessories 38-43
Alignment Tools 98
Allen Keys 98
Alligator Clips 83
bluminium Boxes 77
Amateur Radio 45
Amplifiers Audio - Built 32-34
Answering Machine 50
Antennas - TV, FM 55
Car Radio 46
Antennas Rods & Coils 77
Artwork - PCB 66
Attenuators, Speaker 79
Audio Adaptors 82
Audio Generator 62
Audio Leads 93
Audio Mixers 35
Audio Transformers 79
Aviation Headphones 29

Baluns - TV Antenna 55
Baluns & Formers 77
Banana Plugs 85
Barrel Switches 42
Batteries - Alkaline 46
Button Cell 46
Carbon/Zinc 46
Gel Type 46
Lead Acid 46
NiCad 46
Battery Rechargers 81
Battery - Holders 46
9V Snaps 83
Tester 81
Bench Vices 98
Bezels 71
Binding Posts 85
Bipolar Capacitors 101
Bishop Graphics 66
Blood Pressure Monitor 52
BNC Connectors 82
Boards - Circuit 67
Books 109-112
Boxes 75-77
Braid, De-soldering 96
Breadboard 67
Bridge Rectifiers 108
Burglar Alarms 38-43
Buzzers 42

C

Cabinet Handles 68
Cables - Audio 92, 93
Computer 92, 93
Hookup 92, 93
Instrument 92
Security 92
Speaker 92
Telephone 92
TV 92
Video 92, 93
Wire 92, 93
Cable Clamps/Clips 67
Cable Ties 67
Cabinets 75
Calculators 53
Cannon Connectors 83
Capacitors 100-102
Capacitor Packs 102
Capacitor Suppressors 45
Car Alarms 47
Car Sound Accessories 49
Car Aerial 46
Car Battery Clips 83
Car Fuses 69
Car Radio & Accessories 48-49
Car Relays 86
Car Suppressor Cap 45
Cases 75-77
Cassette, Audio 53
Cathode Ray Osc. 60, 61
CB Radio & Accessories 44-46
Centronics Connectors 84
Ceramic Capacitors 102
Ceramic Capacitor Packs 102
Ceiling Grille 25, 27
Charger - NiCad, Gel 81
Solar 81
Chokes 102
Circuit Breakers 69
Cleaners — Audio 53, 97
Computer 91
Video 53, 97
Clock Movements 53
Cloth, Speaker 29
CMOS IC's 106, 107
Coaxial Cable 92
Coils 77
Component Drawers 70
Component Packs 102
Compressor, CD 34
Computer Accessories 91
Computer Cable 92, 93
Computer Leads/Accs 91
Connectors 84
Contact Cleaner 97
Copperclad PCB 67
Cores 77
Cradle Relays 86
Crimp Connectors 71
Crimping Tool 98
CRO 60, 61
Crocodile Clips 83
Crossovers 29
Crystals 102
Cutters 99

D Connectors 84
Dalo Pen 67
Data 113-117
Data Books 109, 112
Desoldering Bulb 96
Desoldering Tools 95, 96
Desoldering Braid 96
Diacs 108
Diecast Boxes 77
Digital Multimeters 56
Digital Recorder 28
DIL Switch 90
Dimmers 54
DIN Plugs/Skts 83
Diodes 108
Diplexers, TV 55
Displays, 7 Segment LED 108
Double Adp - Telephone 51
Mains 54
Downlight Speakers 27
Drills & Bits 98
Dual Diversity Tx/Rx 36, 37

E

Earpieces 29
Earphones 29
Edge Connector 84
Edge Meter 65
Electrical Tape 96
Electrolube Products 96, 97
Electrolytic Capacitors 100-102
Enamel Copper Wire 93
Etching Equipment 67
Etching Pen 67
Extractor Tool, IC 99

Fans & Guards 91
Fax Switches 50
Feet, Rubber/Plastic 68
Ferric Chloride 67
Ferrite - Rods, ... 77
Cores, ... 77
Beads 77
FET's 104
Filters, Mains 54
Flashing LEDs 108
Flashtubes, Xenon 71
Floodlight Controller 41
Formers, - Coil 77
- Potcore 77
Freezer Spray 97
Frequency Counter - Built 63
Frequency Generators 62
Front Panels — Cases 76
Rack 74, 75
Fuses 69
Fuseclips 69
Fuseholders 69
Fusewire 69

Gas Soldering Irons 94
Gel Batteries 46
Gel Battery Charger 81
General Information 113-118
Globes 71
Globe Holders 71
Glue 96
Gold Connectors 85
Goosenecks 31
Greencaps 102
Greencap Packs 102
Grille Cloth 29
Grilles 25, 27
Grommets 68
Guitar Speaker 21

Handles 68
Hardware 66-77
Headers, Pin 84
Headphones 29
Headphone/Microphone 29
Heatshrink Tubing 93
Heatsinks 73
Heatsink Compound 73
Hi Fi Speakers 20-25
Holders, Battery 46
Hole Cutters 98
Home Alarms 38-43
Hook-Up Wire 92, 93
Horn Speakers 25
Horn Tweeters 24
Horwood Boxes 76

I

IC's 104, 106, 107
IC Extractor Tool 99
IC Inserting Tool 99
IC Sockets 85
IC Plugs 84
IC Test Clips 85
IDC Cable 93
IDC Connectors 84
IEC Plugs/Sockets 54
Illuminated Bezels 71
Infra Red - Detectors 39-41
LED's 108
Indicators 71
Indoor TV Antennas 55
Inductors 77
Innerbond 29
Instrument Cases 76, 77
Insulation Tape 94
Intercoms 50
Intergrated Circuits 104-107
Inverter 81
Irons, Soldering 94, 95

Jacks/Plugs 82-85
Jewellers Screwdrivers 99
Jiffy Boxes 76
Jumper Leads - Car 52
Bench 85

Keyboard Switch 88, 89
Keypad - Alarm 39, 40, 88
Key Switches 42
Kits 4-19
Kit Index 3
Kits, Speaker 19
Knife 66
Knobs 72

Lacquer, Spray 97
Lamps 71
Lamp Relay 86
Lamp Socket 71
Lead Acid Batteries 43, 46
Leads - Audio 93
Computer 91
Car Radio 45
TV 93
Video 93
LED Bar Graphs 108
LED Bezels 68, 71
LED's & Holders 108, 68
Light Dimmers 54
Linear IC's 104
Logic Probe 64
Loudspeakers 20-25
Loudspeaker Accessories 20-25
L Pads 29
Lubricants 96, 97
Lugs 71
Lug Pack 71

Machine Pin IC Skts 85
Magnifying Lamp 96
Magnetic Earpiece 29
Mail Order Form 119
Mains - Filters 54
Terminal Blocks 83
Cable 54, 92
Plugs & Sockets 54
Matrix Pins & Sockets 67
Megaphone 23
Memory IC's 104
Mercury Switch 89
Metal Film Resistors 103
Meter - Panel 65
Multimeter 56-59
Microphones 30, 31
Microphone Acc 31
Microphone Cable 92
Microphone Inserts 30
Microphone Stands 31
Microphone Transformers 79

PHONEORDER TOLL FREE 008 999 007

PHONEORDER TOLL FREE 008 999 007

Micron Soldering Irons 94
Microswitch 88
Midrange Speakers 20-24
Mini Toggle Switches 88, 89
Mixers 35
Molex Pins 85
Monolithic Capacitors 102
Motorola Data Books 112
Movement Detector 39-41
Multimeters - Analogue 56-59

N

National Data Books 109
Neons 71
Nibbling Tool 98
NiCad Batteries 46
NiCad Chargers 81
Nuts & Bolts 70

O

Octal Connectors 83, 86
Opto Couplers 108
Oscillator, Audio 62
Oscilloscopes 60, 61

P

PA Equipment 28, 32-34, 36, 37
PA Transformers 79, 80
PA Speakers 25
Panel Lamps 71
Panel Meters 65
Panels, Racks 75
Parts Cases & Drawers 70
Parts Storage System 70
Passive IR Detectors 39-41
Passives 100-103
PC Artwork & Artknife 66
PC Boards, Blank 67
PC Board Holder 67
PC Drills 98
PC Edge Connector 84
PC Etchant Materials 67
PC Lacquer 97
PCB Pen 67
PC Pins 67
PCB Relays 88, 89
PCB Supports 67
PC Terminals 84
Photo Etch 67, 97
Piezo Buzzers 42
Piezo Sirens 42
Piezo Speakers, Tweeters 24
Pin Switches 43
Plastic Boxes 76
Plastic Tubing 93
Pliers 99
Plugpacks 81
Plugs & Sockets 54
  Banana 85
  BNC 82
  Cannon 83
  Car Radio 82
  Centronics 84
  D Type 84
  DC Power 83
  DIN 84
  Electrical 54
  Headers 84
  IC Sockets 85
  IC Plugs 84
  IDC 84
  Microphone 82
  Octal 83, 86
  RCA 82
  SCART 82
  Speaker 83
  Telephone 51
  TV 82
  ZIF 84
Polypropylene Speakers 22
Portasol 95
Pot Cores 77
Potentiometers 103
Polyester Capacitors 102
Power Cable 92
Power Leads 54
Power Supplies 81
Pressure Mat 43
Probes - CRO 60
  Multimeter 64
  Logic 64
Prototyping Boards 67
Pushbutton Switches 88, 89
PVC Tape 96

Q

Quartz Clock Movements 53
Quick Connect Lugs 71

R

Rack Cabinets 75
Rack Frames 74
Rack Panels 75
Rainbow Cable 93
RCA Connectors 82
Rechargable Batteries 46
Reed Switches & Coils 43
Regulators 108
Relays 86, 87
Resistors 103
Resistor Packs 102
RF Chokes 102
Ribbon Cable 93
Ring Cores 77
RF Generator 62, 64
Rocker Switches 88
Rotary Switches 89
Rubber Feet 68

S

SCART Plug 82
Screwdriver - Neon 98
  Set 99
Screws 70
Security Equipment 38-43, 47
SCR's 108
Semiconductors 104-108
Service Aids 96-99
Shielded Cable 92
Signal Generator 62
Sirens 42
Silastic Compound 94
Silicon Grease 97
Slide Switches 88
Sockets 82-85
Sockets - IC 85
Solar Battery Chargers 81
Solder 96
Solder Lugs 71
Solder Suckers 95-96
Solder Wick 96
Solderless Lugs 85
Soldering Equipment 94-96
Solvent 97
Sound Columns 26
Spacers 70
Speakers 20-25, 49
Speaker Accessories 29
Speaker Crossovers 29
Speaker Cloth 29
Speaker Grilles 25
Speaker Horn 25
Speaker Line Transformer 80
Speaker Kits 19
Speaker Wire 92
Splitters - TV 55
Spade Lugs 71
Spray Cans 96, 97
Standoffs 67
Stickers - Alarm 43
Storage System - Parts 70
Strobe Lamp 43
Storbe Tube (Xenon) 71
Supergiue 96
Suppressors 45
Switches 88-90
  Key 42

T

Tagstrips 83
Tamper Switches 43
Tantalum Capacitors 102
Tape 96
Telephones 50
Telephone Answer Machiner 50
Telephone Double Adaptor 51
Telephone Leads 51
Telephone Plug/Socket 51
Terminals 83
Terminal Strips 83
Test Clips 85
Test Equipment 56-65
Thumbwheel Switch 85
Tinned Copper Wire 93
Toggle Switches 88, 89
Tools 94-99
Toroidal Cores 77
Toroidal Transformers - Audio 80
  Mains 78
Transducers 43
Transformers 79
Transistors 105
Triacs 180
Trimmer Capacitors 102
Trimpots 103
Trigger Transformer 71
TTL IC's 106, 107
Tubing 93
Tuner AM/FM 34
Tuning Capacitors 102
Tweeters 20, 24
Tweezers 98
Twincone Speakers 24
TV Antennas 55
TV Accessories 55
TV Cable 92
TV Leads 93
TV Plugs & Sockets 82

U

UHF TV Antennas 55
UHF Connectors 82
Ultrasonic Cleaner 52
Ultrasonic Tranducers 43
US phone Plugs/Leads 51

V

Velostat 68
Veroboard 67
VHF TV Antennas 55
Vice 98
Video Accessories 53
Video Cables 93
Voltage Regulators 108
VU Meters 65

W

Washers 70
Watch Batteries 46
Weatherproof Speakers 25
Window Foil, Alarm 43
Winding Wire 93
Windscreens 31
Wire & Cable 92, 93
Wire Strippers 99
Wire Wrap 99
Wireless, PA 36, 37
Wirewound Pots 103
Wirewound Resistors 103
Woofers 20-23

X

Xenon Stobe Tube 71

Z

Zener Diodes 108
ZIF Sockets 84

PHONEORDER TOLL FREE 008 999 007

PHONEORDER TOLL FREE 008 999 007

Here is a birds eye view of the daily operations of Altronics in Perth To the many thousands of our Mail Order Customers - don't forget to drop in and say hello next time you visit Perth - we'd be delighted to see you.

ELECTRONICS "SUPERMARKET" 174 ROE ST.

MAIL AND PHONE ORDER CENTRE

R AND D NERVE CENTRE

BULK STORE - ADDED 1988

WAREHOUSE DISTRIBUTION CENTRE

WHOLESALE SALES OFFICE

STAFF AMENITIES "THE BACK DECK"

ALTRONICS

Quality Electronic Products and Components at DIRECT IMPORT PRICES PLUS
Many Products Designed By ALTRONICS and Manufactured in Australia

See inside for:

- Audio, Microphones and Accessories
- Books
- Boxes, Chassis and Hardware
- Cables and Leads
- Capacitors
- CB, Car Sound and Marine
- Connectors, Plugs and Sockets
- Consumer Items
- Kits
- Resistors and Potentiometers
- Security
- Semiconductors
- Switches and Relays
- Test Equipment and Panel Meters
- Tools and Service Aids
- Transformers and Cores

HEAD OFFICE & DISTRIBUTION CENTRE
174 Roe Street,
Perth, W.A.
Phone: (09) 328 1599
Fax: (09) 328 4459
Telex: 94186

Toll Free Order Hotline Phone 008 999 007

Jet Express Delivery — Australia Wide

Supplement to Electronics Australia and Silicon Chip Magazine February 1991

1 GHz Digital Frequency Meter

K 2515 WAS $299
NOW $249 SAVE $50

(See Silicon Chip Nov '87, Jan '88)
This superb 1GHz Frequency Meter will out perform many other instruments twice its price.

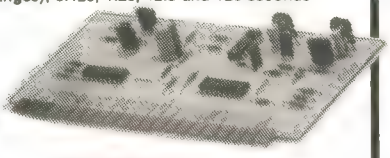
Features include: • Professionally machined and screen-printed red perspex front panel • Easy to assemble • Bright Hewlett Packard 8 digit display • Electronic switch latching • High performance IC's • High Quality components. **Specifications:** Operational Modes: Period frequency to 100MHz freq. to 1GHz freq. **Range:** 100Hz to 1GHz (1.7GHz typical) in frequency mode; 10Hz to 2.5MHz (5MHz typical) in period mode. Gating times: 0.01, 0.1, 1.0 and 10 seconds (10MHz and 100MHz ranges); 0.128, 1.28, 12.8 and 128 seconds (1GHz range).

BENCH AMPLIFIER

(See ETI April '80)
Invaluable for testing all your audio projects.

• 250 milli watts output into 4 Ohms • Runs off single 9V supply • Can give 0.5 watts when run on 12V + heatsink • Complete kit housed in "ABS" jiffy box.

K 2105 ~~$21.70~~ $20



TWIN RANGE LED TACHO

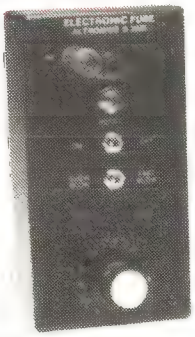
(See ETI Aug '80)
O-1000 RPM/O/10,000 RPM
This unit is suitable for 1, 2, 3, 4, 6 and 8 cylinder vehicles, both 2 stroke and 4 stroke. Fully compatible with conventional CDI and transistorized ignition systems. Includes protection circuitry to prevent noise and high voltage spikes over-revving occurs. Only requires 3 connections to the electrical system.

K 4324 Normally $32.

This month even more fantastic value at only $20. SAVE $12.

DC ELECTRONIC FUSE

(See EA Nov '87)
Calling all servicemen and bench technicians This unit simply clips across the DC Fuse holder. Offers protection adjustable from 0-10A in two ranges. In essence it's an adjustable DC circuit breaker.



Features: Fast blow - slow blow setting. Manual reset button. LED fuse tripped indicator. Operates off 1 single 9V battery (not supplied). Two current settings easily adjustable via a pot and calibrated scale.

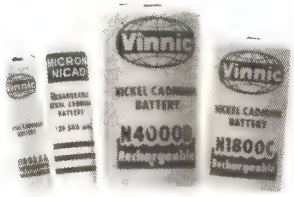
K 2535 Normal Price is $39.50

This Month $34.50

BONANZA NI-CAD SALE!

Premium Grade — Good for up to 1000 recharges!

Charge rates:
45-50mA for AA, 20mA for AAA, 10-15mA for 9V 120mA



Cat No.		1-9	10+
		THIS MONTH	
S 5020	AA 1.2V 500mAh	$2.50	$2.00
S 5021	AAA 1.2V 180mAh	$3.50	$2.90
S 5022	C 1.2V 1.8Ah	$8.00	$7.00
S 5023	D 1.2V Massive 4Ah	$12.00	$10.00

TRANSISTOR TESTER

(See EA Aug '83)
Checks transistor in circuit "NO NEED TO UNSOLDER SUSPECT TRANSISTORS"

K 2530 ~~$17.50~~ $15

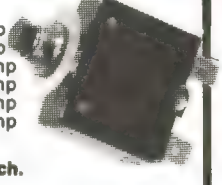
Features:
• Tests both NPN and PNP transistors in circuit at the touch of a switch. • Tests Diodes and SCRs as well. • No need to switch between NPN and PNP - its automatic. • LED indication to show condition of device.

LOW COST RESETTABLE CIRCUIT BREAKER

• Will hold 100% of rated current indefinitely at 25°C. • Will trip within 1 hour at 125% of load at 25°C. • Will trip within 4-40 seconds at 200% rated load.

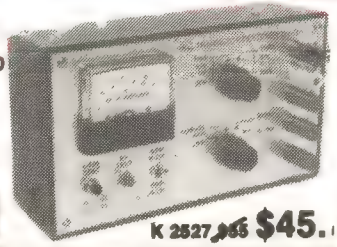
S 5503 3 Amp
S 5505 5 Amp
S 5510 10 Amp
S 5515 15 Amp
S 5520 20 Amp
S 5525 25 Amp

ALL $3 each.



TRANSISTOR,FET ZENER TESTER

(See EA Feb/Mar '88)



New updated circuit incorporates facilities for testing transistors FET's and Zeners etc. FEATURES: • Gain • Leakage • Breakdown voltages • Zener voltage • Polarity - NPN/PNP

K 2527 ~~$55~~ $45.

THERMALLOY TO3

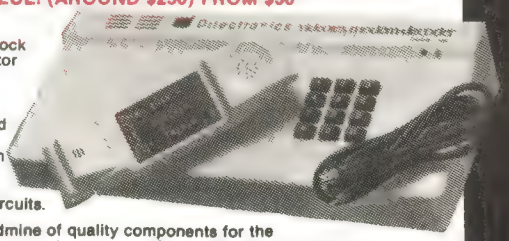
Heat Sink Bargain
H 0503 Value at $1.50
This Month 50¢

"Viatel" (now "Discovery") Sensation!

UNBELIEVABLE VALUE! (AROUND $250) FROM $30

Altronics has recently purchased this quality stock auctioned by the liquidator of DTX Australia LTD.

You can use this equipment to gain limited access to the "Viatel" information system. Each unit contains a Telecom approved modem and information decoding circuits.



The single PCB is a goldmine of quality components for the enthusiast, including the fantastic valuable SAA 5020 and SAA 5050 chips.

ALL STOCK BRAND NEW Sorry no warranty at this price.

Look at this list of component parts!
• Mains Transformer - 240-9/15/24V 300ma • Line isolation Transformer - Telecom approved 600/600 Ohm or 600/150 Ohm impedance • Video/RF Modulator (Channel 0) • Low profile 12V 5A SPDT Relay • Capacitor - 2.0uF 440V AC • Crystals - 6MHz and 4.43MHz • TTL, CMOS, Linlar and LSI ICs - SAA 5020, SAA 5050, 2516 and many more • Voltage regulators • Bridge rectifiers • Trimpots and capacitors • Filter capacitors • Flatpack heatsink 1 Plus much, much more!

VIATEL VIDEOTEX MODEM DECODER

Three models to choose from; Each with a numeric keypad.

X 1000 with RF output ~~$29.95~~ $25

X 1002 with RF o/p & telephone handset ~~$34.95~~ $29

X 1004 with RF and RGB video o/p ~~$34.95~~ $29

PIN POINT ULTRASONIC CLEANER

Will even clean your teeth!

Earns its cost hundreds of times over in cleaning connectors, PCB's, switches, jewellery, glasses, watches, drafting pens, etc. Awarded the Good Product Design Award for CETDC in 1987.

A 0100 Top Value Normally $199

ONLY $149 this month

BATTERY OPERATED PORTABLE P.I.R. INTRUSION ALARM

Ward off thieves and intruders at home and when travelling.

This super handy, go anywhere P.I.R. alarm system is great for shop, office, caravan, boat, garage and whenever you are travelling. ***Extremely easy to install.***

FEATURES:
• Exit delay • Entry delay • Large coverage - up to 100 square metres • Low battery LED indicator • 9V Alkaline battery (not supplied) lasts many months.

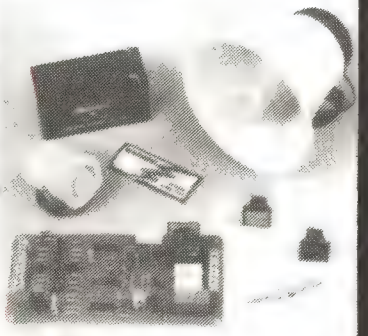
S 5305 ~~$55~~ $49

THE PROTECTOR ALARM KIT

(See SC Feb '88)
This refined car burglar alarm has about every feature you could possibly want to keep would-be thieves away.

Features: Internal and External Sirens. Dash Lamp Flasher. Battery back-up. Delayed and Non-delayed inputs. Easy to build and install.

K 4370 Was $129
Now a Great Special at $119



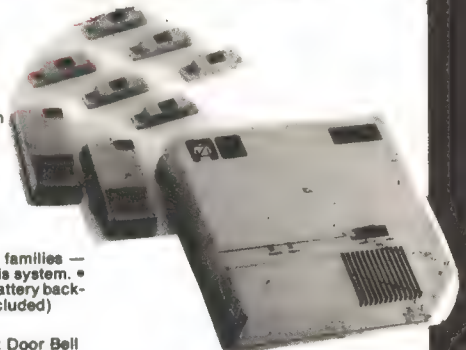
BONUS OFFER

We will include a set of 4 Car Alarm WARNING stickers ($3.95 value) ABSOLUTELY FREE with every Car Alarm Kit ordered this month.

SUPER GUARD HOUSEHOLD ALARM SYSTEM

• Easy to operate Simplicity itself — just select the switch to Home, Off or Away as desired. A 45 second exit/entry delay allows you to vacate and/or re-enter your premises and disarm the system. • No key switches or code buttons to push.
Thus the system is ideal for families — even the kids can operate this system. • Facility for external siren. • Battery back-up (battery 8 'C' cells not included)

System Contents:
• Master Control unit • Front Door Bell Switch • Panic/Emergency Switch • Three Window/Door Reed Switches • Mounting Hardware • 20 Metres Wire • Instruction Manual.



Complete System S 5465 only
~~$125~~ now $85

Build this low-cost sinewave oscillator

This small PC board allows you to build a low distortion sinewave oscillator using only junkbox bits. It runs off a 12V plug pack, gives a low-impedance output signal of up to 6V p-p and costs peanuts to build!

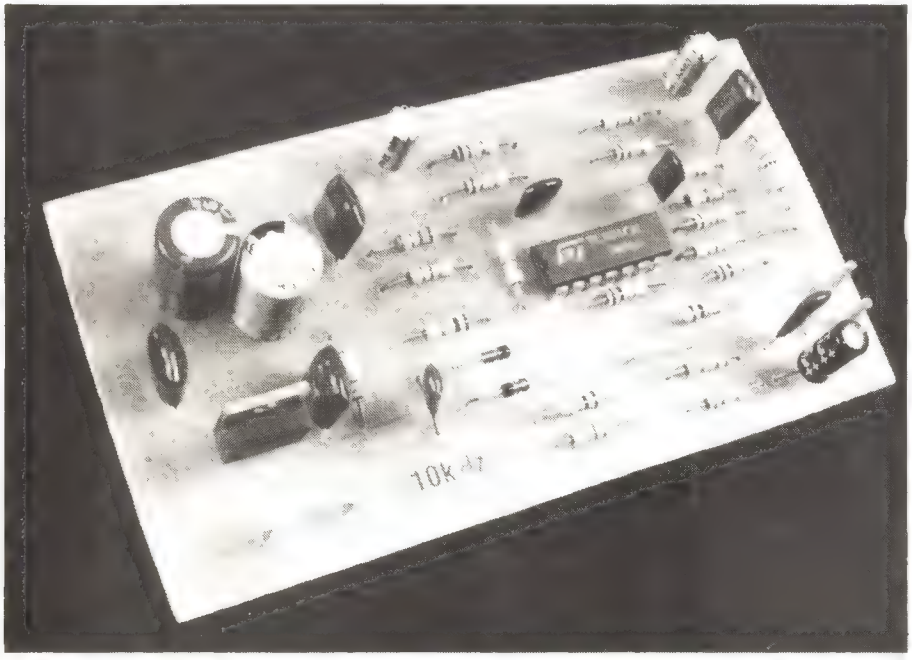
By DARREN YATES

Sinewaves are as fundamental to electronics as resistors and ICs, but unless you're willing to pay big bucks for the generators currently available, professional low distortion sinewave gear is out of reach for most of us.

However, it's only on very rare occasions that you need the wide frequency selection from DC to daylight that these expensive boxes provide.

For example, when you see an operational amplifier quoted in some databook, they'll quote a distortion figure at some particular frequency, usually 1kHz. Most power amplifiers that you buy or see described in magazines, usually provide distortion measurements at selected frequencies. Often, these include 100Hz, 1kHz and 10kHz.

To fill in this present gap, we've designed this project for low distortion (.015% or better), low cost (about $15-$20), and the ability to run from a standard 12VDC plug pack. We've also given you the choice of three very common frequencies: 100Hz, 1kHz or 10kHz.



This is the 10kHz version of the sinewave oscillator but versions for other frequencies look exactly the same (only a few component values are changed). Take care with component orientation when installing the parts on the board.

Circuit theory

So, how do we go about making low distortion sinewaves? Well, in the end, there are two ways of doing this. You can either start out by making the best oscillator money can buy or you can start with a so-so one and improve the signal coming out of it.

We chose the second option because it was easier to do, and a lot cheaper into the bargain! Block diagram Fig.1 shows how it is done.

First of all, we start off with a Wien bridge oscillator, which is one of the oldest circuits around, and then we take the output signal from that and run it through a fairly brutal low-pass filter.

This removes a large amount of the unwanted multiples of the fundamental frequency or "harmonics" which make up what we call "distortion". It does this by increasingly attenuating higher frequencies but allowing the frequency of interest to pass through. These higher frequencies are knocked off at the rate of 24dB/octave. This means that if we started with a 1kHz signal, then the 2kHz harmonic present at the output will be about 24dB below or about 1/16th the amplitude of the 1kHz signal. The 4kHz harmonic would be 48dB below or 1/250th the amplitude of the 1kHz signal, and so on.

The result is a dramatic improvement in distortion. For example, if we start with a sinewave that has about 0.5% distortion, we would end up with a sinewave that has only .01% distortion after filtering - and improvement of 50 times!

The circuit

The circuit diagram is shown in Fig.2. It only requires an LF347N quad

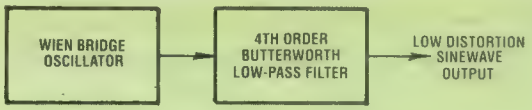


Fig.1: block diagram of the sinewave oscillator. It consists of a modified Wien bridge oscillator driving a 4th order Butterworth low-pass filter. The low pass filter attenuates harmonics above the wanted frequency at the rate of 24dB/octave & this drastically reduces the distortion.

op amp, a couple of signal diodes and a few passive components. You will probably already have some of or all of these components lying around in your spare parts bin or junkbox.

IC1a & IC1b form the Wien bridge oscillator while IC1c & IC1d form the 4th order low-pass Butterworth filter. This 4th order filter actually consists of two 2nd order filter sections connected together. Butterworth filters are easy to calculate and have the advantage of having a flat response across the passband.

You will notice that there are several components on the circuit that have no specific values. If you look at Table 1, these components have different values, depending on the frequency you want. When assembling the unit, you simply go to the frequency you want and read off the corresponding component value.

Looking at the circuit, IC1a and IC1b form an unusual Wien bridge in that resistor R2 is not returned to ground as in conventional designs, but forms part of the unity-gain inverting amplifier formed by IC1b. This provides gain compensation and helps stablise the output amplitude.

Diodes D1 and D2 also do this job but because they are non-linear in their response, the more they interfere with the signal, the more distortion they produce. Most designs use a thermistor or small 12V light globes for this job. We chose the diodes because suitable thermistors can be expensive and hard to get while lamps require extra current and, because of their slow repsonse, take some time to reach their final resistance. This results in a sinewave which has a fairly long settling time, particularly at low frequencies.

The diodes speed up this process and because of the high value of resistor R6 (470kΩ to 1.2MΩ) in series, they only have minimal affect on signal distortion.

The gain of IC1a is set by resistors R4, R5 & R7. Resistor R7 sets the gain of IC1a just enough for the oscillator to start. If we have too much gain, the oscillator starts OK but introduces heaps of distortion; if we don't have enough gain, then it won't start at all!

The Wien bridge itself is formed by components R1, R2, C1 & C2. The frequency of the sinewave produced is:

$$F = 1 /(2\pi R1C1).$$

The sinewave produced at the output of IC1a (pin 1) will have a total harmonic distortion of about 0.5% to 1% - which is certainly nothing to write home about.

Low-pass filter

The signal from pin 1 of IC1a is DC-coupled to the first stage of the filter formed by IC1d and its associated components. This section has a 3dB cutoff frequency set to the frequency of interest - whether it be 100Hz, 1kHz or 10kHz - by selecting the correct components from Table 1.

This leaves us with a problem, though. To get maximum effect from the filters, we need to set their cutoff frequency at our frequency of inter-

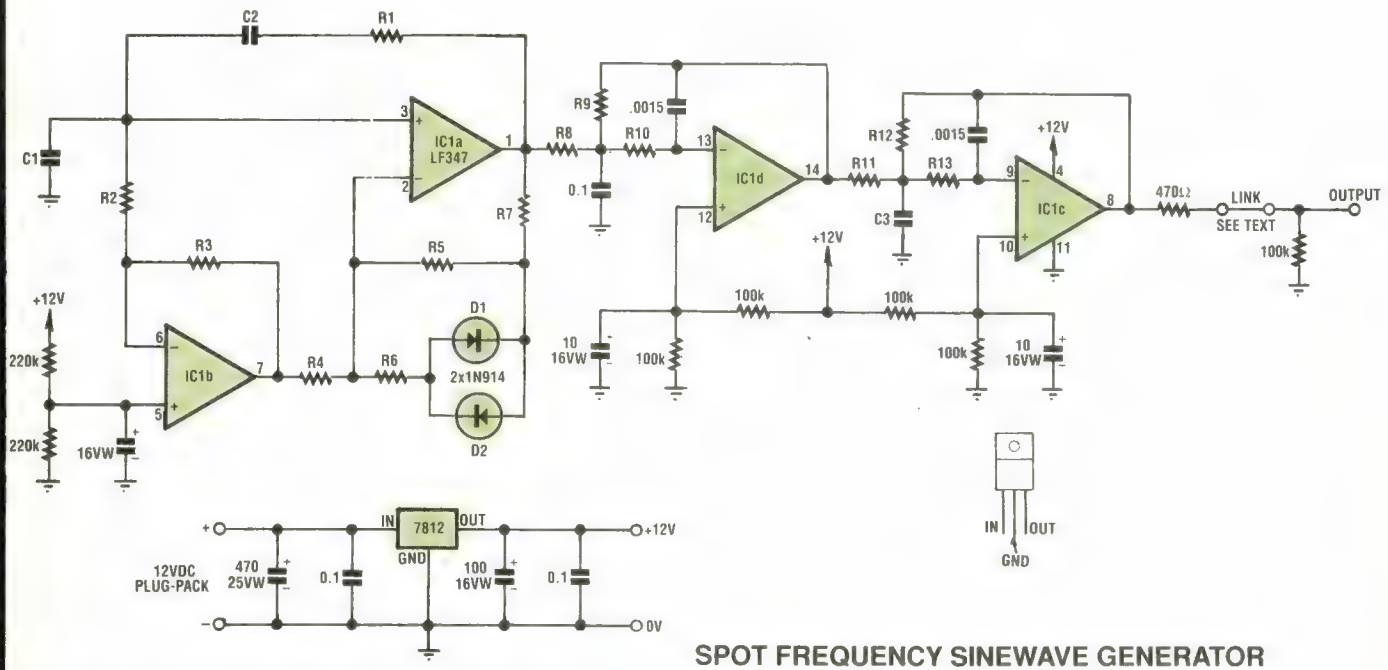


Fig.2: the final circuit is based on a single LF347 quad op amp package. IC1a & IC1b form the Wien bridge oscillator, while IC1c & IC1d together make up the 4th order Butterworth filter. Note that some of the resistor & capacitor values are selected to give the desired frequency.

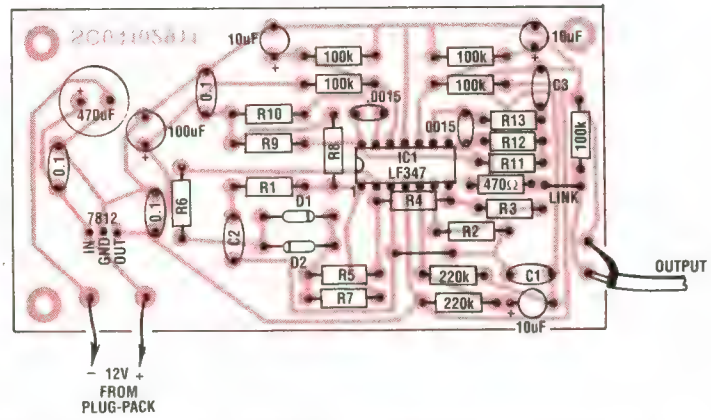


Fig.3: take care with component orientation when installing the parts on the PC board. Table 1 shows the values for R1-R13 & C1-C3 for three frequencies: 100Hz, 1kHz & 10kHz.

est. But this results in about 3dB attenuation of the signal. By the time it has gone through both sections, we would then get 6dB attenuation. In other words, the signal is reduced to half its original amplitude.

To overcome this, we give each section a gain of roughly 3dB (or 1.42), so in the end, the filters have unity gain at the frequency we want.

By the time the signal comes out of IC1d, its distortion is of the order of .05% to 0.1% - an improvement, but we can still go better than that!

In giving the filters extra gain, we are also amplifying the harmonics, but since they are still being attenuated at the rate of 24dB/octave, the relative amplitude of the wanted frequency to those we don't want remains unchanged. In other words, it doesn't make the distortion worse.

The final signal is taken from the output of IC1c (pin 8) where the distortion has now dropped to around .015% for the 100Hz and 1kHz versions, and to about .005% for the 10kHz version.

We have set the output impedance of the circuit at 470Ω with the resistor at the output but you can increase this to 600Ω or any other value to suit your application. If you wish, you can replace the wire link at the output with a 22µF 16VW electrolytic capacitor to provide DC isolation.

You can also reduce the output signal amplitude by changing the 470Ω and 100kΩ output resistors with a potential divider of your own. For example, with two 1kΩ resistors, the output would be reduced to half.

Table 1: Component Values

	100Hz	1kHz	10kHz
Resistors			
R1, R2, R3, R4, R5	15kΩ	100kΩ	10kΩ
R6	470kΩ	1.2MΩ	820kΩ
R7	330Ω	4.7kΩ	470Ω
R8	18kΩ	1.8kΩ	470Ω
R9	27kΩ	3.3kΩ	470Ω
R10	560kΩ	47kΩ	5.6kΩ
R11	18kΩ	1.8kΩ	1.5kΩ
R12	27kΩ	3.3kΩ	2.7kΩ
R13	560kΩ	47kΩ	5.6kΩ
Capacitors			
C1	0.1µF	.0015µF	.0015µF
C2	0.1µF	.0015µF	.0015µF
C3	0.1µF	0.1µF	.015µF

Power supply

Power is provided by a 12V DC plugpack which drives a 7812 3-pin 12V regulator. Even though this regulator requires a couple of volts of headroom to operate correctly, typical 12V DC plugpacks provide about 16-17V DC when lightly loaded and and so will work perfectly well with this circuit. Extra decoupling and filtering of the power supply is provided by the 100µF and 470µF electrolytics, as well as 0.1µF greencaps.

Construction

All components for the oscillator are mounted on a PC board which is coded SC04102911 and measures 104 x 57mm. This can also be housed in a standard zippy box, measuring 130 x 68 x 41mm. As there are no controls to mount on the front panel, it is a simple case of drilling two holes, say for an RCA socket for the output signal and a DC socket for the power supply.

Before you start assembly, check the board carefully for breaks or shorts in the tracks. If there are any, it's best to correct them now.

Once you're happy that everything is OK, take a look at the wiring diagram. This shows you where each component fits into place.

Begin by installing the wire links and the resistors. Some of the colour bars on the resistors may be difficult to distinguish, in which case, use your multimeter to make sure of the correct value. Again, make sure that you have the correct resistors and capacitors for the selected frequency from Table 1.

Now install the diodes. It's best to do this now while the flat components only are on the board, otherwise they become difficult to put in. It doesn't matter which way round you put the two diodes in, as long as they face in opposite directions. We suggest that you put them in as shown on the wiring diagram.

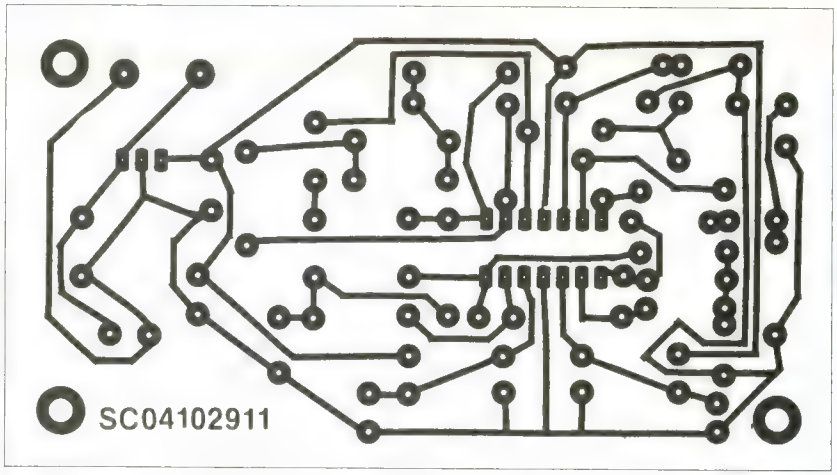


Fig.4: compare your PC board against this full-size artwork before installing any of the parts.

Next, solder in the PC stakes. You may need to hammer these in, depending on the type of pins you get, or you can enlarge the holes using an appropriate drill.

The capacitors can now be installed. Make sure you get the polarity of the electrolytics correct, particularly those in the power supply, otherwise they could quite easily pop.

All that should be left is the two ICs. Solder in the 7812 regulator first and then the LF347.

Testing

Now check over the board again and compare it to the wiring diagram. When you're sure the board is correct, you can hook up the power supply. When you do so, put your multimeter, switched to a DC milliamps range, in series with the power supply and the circuit. The current drain should be no more than about 20mA. If you get more than this, then it is possible you have a short circuit somewhere.

If you have a CRO, monitor the output and check that you get a stable sinewave at the frequency you selected. If you don't have a CRO, just connect it up to an audio amplifier (turn the volume control down first). If you hear a tone when you turn the volume up, it's a good bet that the circuit is working correctly.

If you don't get any signal, first check that there is 12V at the output of the regulator. If that's OK, check that it appears across pins 4 and 11 of IC1. If the voltage is there, try touching both sides of the diodes with your finger. If the signal appears and then dies away when you remove your finger, then it is probably due to the fact that IC1a doesn't have enough gain to keep oscillating. To fix this, change R7 to the next highest standard value; ie, if it was 330Ω, make it 390Ω instead.

Once the circuit is working, you may like to house it in a zippy box to keep the dust and bugs away from it. For those who may have access to the necessary equations, you may like to try to work out other frequencies as you need them. The LF347N should be capable of producing a clean sinewave at well above 20kHz. **SC**

PARTS LIST

1 PC board, code SC04102911, 105 x 57mm
1 12VDC plug pack
4 PC stakes

Semiconductors
1 LF347N quad FET-input op amp (IC1)
1 7812 +12V regulator
2 1N914 signal diodes (D1, D2)

Capacitors
1 470µF 25VW PC electrolytic
1 100µF 25VW PC electrolytic
3 10µF 25VW PC electrolytic
4 0.1µF metallised polyester (greencaps)
4 .0015µF metallised polyester

Resistors (0.25W, 5%)

1 1.2MΩ	1 4.7kΩ
2 220kΩ	2 3.3kΩ
10 100kΩ	2 1.8kΩ
2 47kΩ	1 470Ω

Miscellaneous
Solder, hookup wire etc

Note: This parts list is for the 1kHz version. Other versions will require different resistor & capacitor values - see Table 1.

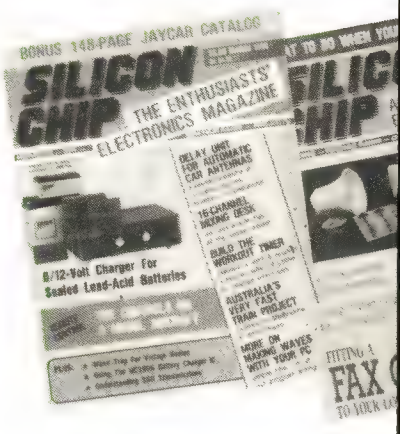
CAPACITOR CODES

Value	IEC Code	EIA Code
0.1µF	100n	104
.015µF	15n	153
.0015µF	1n5	152

RESISTOR CODES

No	Value	4-Band Code (5%)	5-Band Code (1%)
1	1.2MΩ	brown red green gold	brown red black yellow brown
2	220kΩ	red red yellow gold	red red black orange brown
10	100kΩ	brown black yellow gold	brown black black orange brown
2	47kΩ	yellow violet orange gold	yellow violet black red brown
1	4.7kΩ	yellow violet red gold	yellow violet black brown brown
2	3.3kΩ	orange orange red gold	orange orange black brown brown
2	1.8kΩ	brown grey red gold	brown grey black brown brown
1	470Ω	yellow violet brown gold	yellow violet black black brown

Silicon Chip BACK COPIES


BONUS 148-PAGE JAYCAR CATALOG
SILICON CHIP
THE ENTHUSIASTS' ELECTRONICS MAGAZINE
8/12-Volt Charger For Sealed Lead-Acid Batteries
DELAY UNIT FOR AUTOMATIC CAR AERIALS
16-CHANNEL MIXING DESK
BUILD THE WORKOUT TIMER
AUSTRALIA'S VERY FAST TRAIN PROJECT
MORE ON MAKING WAVES WITH YOUR PC
FAX

May 1988: Optical Tachometer For Aeromodellers; High Energy Ignition For Cars; Ultrasonic Car Burglar Alarm; Walkaround Throttle For Model Railroads, Pt.2; Designing & Building RF Attenuators; Motorola MC3334P High Energy Ignition IC Data.

July 1988: Stereo Control Preamplifier, Pt.2; Fitting A Fuel Cut-Off Solenoid; Booster For TV & FM Signals; The Discolight Light Show, Pt.1; Tone Burst Source For Amplifier Headroom Testing; What Is Negative Feedback, Pt.3; Amcron MA-1200 Power Amplifier Review; Amplifier Headroom - Is It A Con?

August 1988: Building A Plasma Display; Universal Power Supply Board; Remote Chime/Doorbell; High Performance AC Millivoltmeter, Pt.1; Discolight Light Show, Pt.2; Getting The Most Out Of Nicad Batteries; Data On Insulated Tab Triacs.

September 1988: Hands-Free Speakerphone; Electronic Fish Bite Detector; High Performance AC Millivoltmeter, Pt.2; Vader Voice; Motorola MC34018 Speakerphone IC Data; National Semiconductor LM12 150W Op Amp Data & Applications; What Is Negative Feedback, Pt.4.

October 1988: Stereo FM Transmitter (Uses Rohm BA1404); High Performance FM Antenna; Matchbox Crystal Set; Electronic House Number; Converting A CB Radio To The 28MHz Band; Queensland's Powerful Electric Locomotives.

November 1988: 120W PA Amplifier Module (Uses Mosfets); Poor Man's Plasma Display; Automotive Night Safety Light; Adding A Headset To The Speakerphone; How To Quieten The Fan In Your Computer; Screws & Screwdrivers, What You Need To Know; Diesel Electric Locomotives.

December 1988: 120W PA Amplifier (With Balanced Inputs), Pt.1; Diesel Sound Generator; Car Antenna/Demister Adaptor; SSB Adaptor For Shortwave Receivers; Electronics & Holden's New V6 Engine; Why Diesel Electrics Killed Off Steam; Index to Volume 1.

January 1989: Line Filter For Computers; Ultrasonic Proximity Detector For Cars; Simple Computer Sound Repeater; 120W PA Amplifier (With Balanced Inputs) Pt.1; How To Service Car Cassette Players; Massive Diesel Electrics In The USA; Marantz LD50 Loudspeakers.

February 1989: Transistor Beta Tester; Minstrel 2-30 Loudspeaker System; LED Flasher For Model Railways (uses LM3909); Build A Simple VHF FM Monitor (uses MC3362), Pt.1; Lightning & Electronic Appliances; Using Comparators to Detect & Measure.

March 1989: LED Message Board, Pt.1; 32-Band Graphic Equaliser, Pt.1; Stereo Compressor For CD Players; Map Reader For Trip Calculations; Amateur VHF FM Monitor, Pt.2; Signetics NE572 Compandor IC Data; Electronics For Everyone - Resistors.

April 1989: Auxiliary Brake Light Flasher; Electronics For Everyone: What You Need to Know About Capacitors; Telephone Bell Monitor/Transmitter; 32-Band Graphic Equaliser, Pt.2; LED Message Board, Pt.2.

May 1989: Electronic Pools/Lotto Selector; Synthesised Tom-Tom; Biofeedback Monitor For Your PC; Simple Stub Filter For Suppress-

Use this handy form to order your back copies

Please send me a back issue for:

❑ September 1988	❑ October 1988	❑ May 1988	❑ July 1988	❑ August 1988
❑ February 1989	❑ March 1989	❑ November 1988	❑ December 1988	❑ January 1989
❑ July 1989	❑ August 1989	❑ April 1989	❑ May 1989	❑ June 1989
❑ December 1989	❑ January 1990	❑ September 1989	❑ October 1989	❑ November 1989
❑ May 1990	❑ June 1990	❑ February 1990	❑ March 1990	❑ April 1990
❑ October 1990	❑ November 1990	❑ July 1990	❑ August 1990	❑ September 1990
		❑ December 1990	❑ January 1991	

Enclosed is my cheque/money order for $_____or please debit my: ❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | | |

Signature _____ Card expiry date_____/_____

Name _____

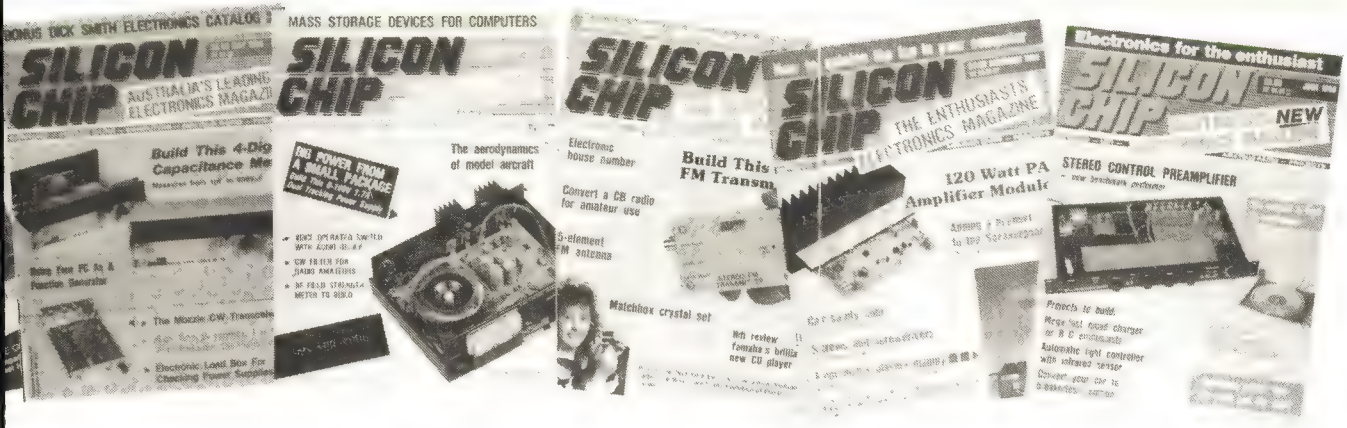
Street _____

Suburb/town _____ Postcode _____

$5.00 each (includes p&p). Overseas orders add $1 each for postage. NZ orders are sent air mail.

Detach and mail to:
SILICON CHIP PUBLICATIONS
PO BOX 139
COLLAROY BEACH NSW 2097

Or call (02) 979 5644 & quote your credit card details. Fax (02) 979 6503



ing TV Interference; LED Message Board, Pt.3; Electronics for Everyone - All About Electrolytic Capacitors.

June 1989: Touch-Lamp Dimmer (uses Siemens SLB0586); Passive Loop Antenna For AM Radios; Universal Temperature Controller; Understanding CRO Probes; LED Message Board, Pt.3; Coherent CW - A New Low Power Transmission Technique.

July 1989: Exhaust Gas Monitor (Uses TGS812 Gas Sensor); Extension For The Touch-Lamp Dimmer; Experimental Mains Hum Sniffers; Compact Ultrasonic Car Alarm; NSW 86 Class Electrics; Facts On The PhaxSwitch - Sharing Your Phone Line With A Fax Machine.

August 1989: Build A Baby Tower AT Computer; Studio Series 20-Band Stereo Equaliser, Pt.1; Garbage Reminder - A 7-day Programmable Timer; Introduction To Stepper Motors; GaAsFet Preamplifier For The 2-Metre Band; Modern 3-Phase Electric Locomotives.

September 1989: 2-Chip Portable AM Stereo Radio (Uses MC13024 and TX7376P) Pt.1; Alarm-Triggered Telephone Dialler; High Or Low Fluid Level Detector (uses LM1830N); Simple DTMF Encoder (uses Texas TMC5089); Studio Series 20-Band Stereo Equaliser, Pt.2; Auto-Zero Module for Audio Amplifiers (Uses LMC669); A Guide To Hard Disc Drives.

October 1989: Introducing Remote Control; FM Radio Intercom For Motorbikes (Uses BA1404 And TDA7000) Pt.1; GaAsFet Preamplifier For Amateur TV; 1Mb Printer Buffer; 2-Chip Portable AM Stereo Radio, Pt.2; Installing A Hard Disc In The PC; A Look At Australian Monorails.

November 1989: Radfax Decoder For Your PC (Displays Fax, RTTY and Morse); Super Sensitive FM Bug; Build A Low Cost Analog Multimeter; FM Radio Intercom For Motorbikes, Pt.2; 2-Chip Portable AM Stereo Radio, Pt.3; Floppy Disc Drive Formats & Options; The Pilbara Iron Ore Railways.

December 1989: Digital Voice Board (Records Up To Four Separate Messages, Uses Texas TMS3477NL and 256K RAMs); UHF Remote Switch; Balanced Input & Output Stages; National Semiconductor LM831 Low Voltage Amplifier IC Data; Install A Clock Card In Your PC; Index to Volume 2 (Jan-Dec 1989).

January 1990: Service Tips For Your VCR; Speeding Up Your PC; Phone Patch For Radio Amateurs; High Quality Sine/Square Oscillator; Active Antenna Kit; The Latest On High Definition TV; Speed Controller For Ceiling Fans; Designing UHF Transmitter Stages.

February 1990: 16-Channel Mixing Desk; High Quality Audio Oscillator, Pt.2; The Incredible Hot Canaries; Random Wire Antenna Tuner For 6 Metres; Phone Patch For Radio Amateurs, Pt.2; PC Program Calculates Great Circle Bearings.

March 1990: 6/12V Charger For Sealed Lead-Acid Batteries; Delay Unit For Automatic Antennas; Workout Timer For Aerobics Classes; 16-Channel Mixing Desk, Pt.2; Using The UC3906 SLA Battery Charger IC; Digital Waveform Generation Using a PC; The Controls On A Model Aircraft.

April 1990: Dual Tracking ±50V Power Supply; VOX With Delayed Audio; Relative Field Strength Meter; 16-Channel Mixing Desk, Pt.3; Simple Service Tips For Your Microwave Oven; Model Aircraft Aerodynamics; Active CW Filter For Weak Signal Reception.

May 1990: Build A 4-Digit Capacitance Meter; High Energy Ignition For Cars With Reluctor Distributors; The Mozzie CW Transceiver; Waveform Generation Using A PC, Pt.3; 16-Channel Mixing Desk, Pt.4; What To Do When Your Computer Goes Bung, Pt.1; Electronic Load For Checking Power Supplies.

June 1990: Multi-Sector Home Burglar Alarm; Low-Noise Universal Stereo Preamplifier; Load Protection Switch For Power Supplies; A Speed Alarm For Your Car; Design Factors For Model Aircraft; Fitting A Fax Card To Your Computer; What To Do When Your Computer Goes Bung, Pt.2.

July 1990: Digital Sine/Square Generator, Pt.1 (Covers 0-500kHz); Burglar Alarm Keypad & Combination Lock; Simple Electronic Die; Low-Cost Dual Power Supply; Inside A Coal Burning Power Station; What To Do When Your Computer Goes Bung, Pt.3; Digital Waveform Generation Using A Computer, Pt.4.

August 1990: High Stability UHF Remote Transmitter; Universal Safety Timer For Appliances; Horace The Electronic Cricket; Digital Sine/Square Wave Generator, Pt.2; The Tube Vs. The Microchip (Two Shortwave Receivers Compared); What To Do When Your Computer Goes Bung, Pt.4.

September 1990: Music On Hold For Your Telephone; Remote Control Extender For VCRs; Power Supply For Burglar Alarms; Low-Cost 3-Digit Counter Module; Voice Mail For Your Computer; Simple Shortwave Converter For The 2-Metre Band; How To Make Dynamark Labels.

October 1990: Low-Cost Siren For Burglar Alarms; Dimming Controls For The Discolight; Surfsound Simulator; DC Offset For DMMs; The Dangers of Polychlorinated Biphenyls; The Bose Lifestyle Music System; Using The NE602 In Home-Brew Converter Circuits.

November 1990: Low-Cost Model Train Controller; Battery Powered Laser Pointer; A Really Snazzy Egg Timer; 1.5V To 9V DC Converter; How To Connect Two TV Sets To One VCR; Introduction To Digital Electronics; Simple 6-Metre Amateur Transmitter.

December 1990: DC-DC Converter For Car Amplifiers; The Big Escape; Wiper Pulser For Rear Windows; Versatile 4-Digit Combination Lock; 5W Power Amplifier For The 6-Metre Amateur Transmitter; The Green CD Pen Controversy.

January 1991: Fast Charger For Nicad Batteries; Have Fun With The Fruit Machine; Two-Tone Alarm Module; Laser Power Supply (For Tubes With Ratings Up To 10mW); LCD Readout For The Capacitance Meter; How Quartz Crystals Work; The Dangers When Servicing Microwave Ovens; Electric Vehicles - The State Of The Art.

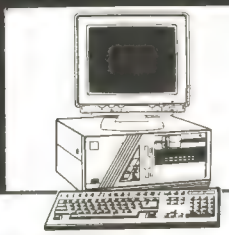
PLEASE NOTE:

All issues from November 1987 to April 1988, plus June 1988, are now sold out. All subsequent issues are presently in stock. For readers wanting articles from issues out of print, we can supply photostat copies (or tearsheets) at $5.00 per article, including postage. When supplying photostat articles or back copies, we automatically supply any relevant Notes & Errata, at no extra charge.

FREE 148 PAGE ELECTRONICS CATALOGUE WITH 32 PAGES OF DATA FREE WITH EVERY ORDER OVER $100

RITRON EXECUTIVE COMPUTER SYSTEMS

FOR TOP QUALITY AND GREAT VALUE YOU CAN'T GO PAST RITRON EXECUTIVE.



RITRON 386SX-16

- 80386SX-16
- 42 MEG 28ms HD
- 1.2 MEG 5 1/4" DRIVE
- 16 BIT 512K VGA CARD
- VGA COLOUR MONITOR (1024 x 768)
- SERIAL, PARALLEL JOYSTICK PORTS
- 101 KEYBOARD
- 12 MONTHS WARRANTY

$2295

RITRON EXECUTIVE 386-33 56 MHz LANDMARK

- IDEAL CAD MACHINE, 33M WITH CACHE
- 1.2M FDD
- 1MB RAM & EXPANDABLE
- MASSIVE 42M BYTE HDD. 19ms
- SUPER VGA .28 DOT PITCH (1024 x 768) COLOUR MONITOR.
- 512K VGA CARD, (256 COLOUR)
- 101 EXTENDED KEYBOARD
- 2 x SERIAL PARALLEL, GAMES & PRINTER PORTS

$3295

VGA 40 MEG AT with SUPER VGA Colour monitor (1024x768)

- MINI CASE & P S
- 101 KEYBOARD
- IDE/FDC CARD
- VGA 256K CARD
- 42 MEG HD 28ms
- 1.2 MFDD
- 1M RAM
- (16 MHz LANDMARK) 12M MB
- 12 MONTHS WARRANTY

FREE SPREADSHEET WORDPROCESSOR SOFTWARE

DON'T PAY $1990!

$1675

RITRON EXECUTIVE 386 SX-16 WITH 85M HDD

- SUPER FAST 21M LANDMARK
- 512K VGA CARD
- 2MB RAM
- MASSIVE 85 MEG HD 18ms
- 1.2 M FLOPPY
- MINI CASE & 200W PS
- 2 YEAR WARRANTY
- SUPER VGA (1024 x 768) COLOUR MONITOR
- SERIAL, PARALLEL & GAMES PORTS
- 101 EXTENDED KEYBOARD

$2695

AUSTRALIA'S TOP SELLING NOTEBOOK!

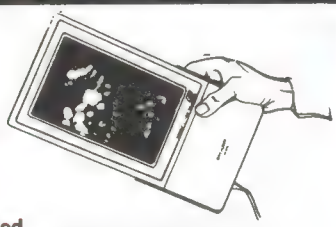
PC-4741 COMPACT NOTEBOOK.

- Triple super twist LCD (640 x 400) with 4 shades of grey
- 8088 compatible processor with 10MHz clock speed (socket for 8087 coprocessor)
- 40 MB hard disk drive with 29ms access time
- 3.5" 1.44MB high density floppy disk drive
- 640 Kb internal RAM expandable to 1.5 MB
- Weighs only 3.8 Kg
- Battery or mains operated

X20004.....$3499

(Available to order)

SHARP JX-100 Colour Scanner



Sharp invented the colour scanner and we have scooped a batch of their A6 size units for you. Compatible with the Apple Mac II and with IBM or equivalents this impeccable unit brings quality scanning within easy operational and financial reach. For IBM the RPP (including MS Windows and Mouse) is $1499, and for the Mac $1299.

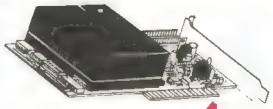
SPECIFICATIONS:

Type: Flat Bed
Resolution: 200 dpi
Image Size: 100mm x 160mm
Colours: 262, 144
Grey Levels: 64
Colour range: 6 bit
Colour Accuracy: 6 bit
Interface: RS232C
Supplied Software:
Mac II: Chromascan 100
IBM: Microsoft windows with mouse, Colour Lab 100

IBM X19905.....$1499

MAC X19907.....$1299

SAFE CARD POWER FAIL PROTECTOR



NEW

The revolutionary Safe Card Power Fail Protector. This little gem takes away all the risk of losing hours of important work when the power dips or fails. Ideal for areas where power is a problem or data integrity is vital. The need for a huge bulky in-line back-up system is now eliminated by the single slot 1/2 Card. Introductory offer for this Australian promoted product is $595 and only available from us.

X11118.....$595

SCAN YOUR EYES OVER THESE GREAT COMPUTER IDEAS!

COLOUR YOUR WORLD WITH THE GS-C105 Colour Scanner

SAVE $100

The GS-C105 Colour scanner scans any colour or Black & White image into your IBM PC AT, PS-2 or compatible system without loss of hue.

FREE SOFTWARE!

The powerful Colour Maestro allows you to scan an image and then do colour editing in colours you can create yourself! You can draw different shapes, modify objects, alter colours and edit a palette of 256 colours by using the commands on your pop-up menus. You can even design your own font type size.

SPECIFICATIONS:

- 105mm scan width, multi-scan up to 300mm
- 100-400 DPI selecable in steps of 10 DPI for 2,8, & 16 colours
- 64 shade levels
- Scanning speed: 3.5 ms/line

.....$895

HS - 3000 HANDY SCANNER

INCLUDES *FREE SOFTWARE!* PC PAINTBRUSH & IMAGE TOOL

$299

- WIDE 4.13" (105mm) scan width
- 100/200/300/400 switchable DPI resolution.

Four encoded modes: B/W and three half tone patterns.

- Thrity-two shades of grey.
- Built-in scanner view window for accurate scanner placement.

X19945.....$299

PARALINK II

NEW

Parallel Interface Extender

RANGE UP TO 400 METRES!

In the real world of interfacing computers to parallel printers, it is often very useful to extend the distance over the normal 10 foot limitation. Paralink II is the inexpensive and effective way to do this. It's ultra high speed transmission rate produces parallel-like speed. It is compatible with all software & hardware & installs in seconds because there is no need for an external power source. Comes complete with a transmitter, receiver & 50 feet of straight through RJ-11 modular cable.

C22162.....$395

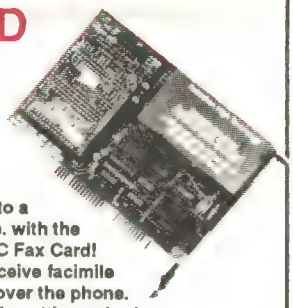
008 335757 TOLL FREE MAIL ORDER HOTLINE FOR CREDIT CARD ORDERS!

ROD IRVING ELECTRONICS

FREE 148 PAGE ELECTRONICS CATALOGUE WITH 32 PAGES OF DATA FREE WITH EVERY ORDER OVER $100

RODRIVING ELECTRONICS

NetComm FAX CARD



Turn your computer into a Fax Machine. with the NetComm PC Fax Card! Send and receive facimile documents over the phone.
- Multi speed, multi standard.
- PSTN Dial up
- 12 months warranty
- Australian design & manufactured
- Telecom approved

INCLUDED WTIH FAX CARD:
- Users manual
- Telephone cord
- Three 5 1/4 floppy disks containing " PC fax card " software.

X19091.....$595

AUTOMATIC TELEPHONE ANSWER/ CALL CARD

TURN YOUR IBM* PC, XT, AT INTO A FULLY FUNCTIONAL ANSWERING MACHINE!!!

A Sophisticated Voice coil mail system
- Auto answering Dialing
- 100 voice mail boxes
- Password protection
- Message mailing
- Auto redialing
- Beeperless remote control
- Toll saver
- Call screening
- Electronic phone book
- Works in background
- Menu driven software
- Simple and concise operation

Not only can this card turn your computer into a 24 hour personal receptionist , but can answer with different phone messages for particular callers.

X19084.....ONLY $199

MICE

FREE MOUSE HOUSE & MOUSE MAT $20 VALUE

INCREDIBLY POPULAR

QUICK MOUSE
...OFT' COMPATIBLE!
...and auto-
...use
...system ...
mode and Mic...
mouse mode
- Microsoft Serial Mouse ...
Mouse System compatible
- Super high tracking speed 600mm sec
- Super high resolution. 200 D.P.I (0.12mm dot)
- Silicon rubber coated ball
- Optical rotary encoder

X19952..... $79.95

EVER POPULAR LOW BUDGET

WITTY MOUSE

NOW $39.95

- Three buttons, user definable
- Silicone coated steel ball
- High resolution movement of 195 dots inch Smaller table space and less hand movement required
- Optical rotary encoder
- Max tracking speed 200m sec
- Mouse resident firmware
- Size 116 x 66 x 34mm
- Mouse Driver Software included, allowing you to install with all popular software packages Also included is the handy Pop-up menu software that allows the user to integrate the mouse with the keyboard, DOS, and other popular software packages

X19950..... $39.95

TOUCH MOUSE

A STATIONARY BREAK THROUGH

SAVE $40

Now you can use your fingers instead of your mouse.
MODELS: ATM- 110 Touch Mouse for IBM PC/ XT/ AT and compatible's, Operates under Microsoft / mouse system mode.
FEATURES:
- User's finger movements on the 58 X 48mm front panel of the touch mouse control the on- screen cursor movement.
- With no ball, the touch mouse requires no desk space for movement.
- No pad to get dirty and take up desk space.
- One finger can do all the users drawing.
- Compatible with all existing mouse software.
- RS- 232 serial port
- Especially suitable for laptops, the touch mouse saves on desk space.

FREE SOTWARE INCLUDED!
- MOUSE DRIVER
- TEST PROGRAM
- DEMO PROGRAM
- HIGH LEVEL LANGUAGE INTERFACE ROUTINE: Microsoft C, Microsoft Fortran, Quick Basic, Turbo C Pascal ...etc.
- POP-UP MENU
- DR. HALO III GRAPHICS SOFTWARE

X19960.....$109

MOTHERBOARDS

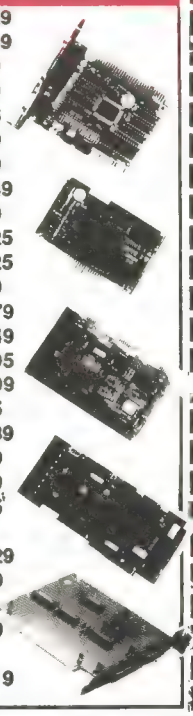
21 MHz ALL IN ONE AT MOTHERBOARD WITH THE LOT!

All you have to do is add a Graphics card. This ultra high performance PC/AT motherboard has everything! This top quality motherboard uses state of the art ACER technology & surface mount design for the best performance & reliability.
- 16 MHz o wait state CPU (21 MHz landmark speed rating)
- Up to 4MB of RAM on the Motherboard 0 Ram fitted ons or 100ns RAM can be fitted.
- 3 x 16 bit & 3 x 8 bit expansion slots
- 2 Serial & 1 Parrallel Port
- Dallas real time clock fitted life expectancy 10 years
- IDE 40 pin connector for hard disk interface (You just need to add an imbedded hard disk drive)
- Floppy disk controller on board
- You only have to add a Graphics card.

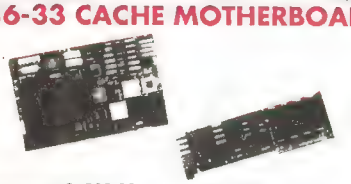
X18198.....$595

CHECK OUT OUR HUGE RANGE OF IBM CARDS AVAILABLE.

XT HD CONTROLLER.....	$129
AT HD CONTROLLER.....	$199
RS 232 SERIAL CARD.....	$49
RS232 / SERIAL / CLOCK..	$59
MONO / COLOUR CARD....	$96
MULTI I/O.....	$99
512K RAM.....	$59
DIAGNOSTIC.....	$849
TTL / PRINTER.....	$89
RAM 2M AT EXT/EXP.....	$225
8M AT EXT / EXP.....	$325
4 PORT SERIAL.....	$89
VGA 256K.....	$179
VGA 512K.....	$249
VGA 1 MEG.....	$395
VOICE MAIL CARD.....	$199
PRINTER CARD.....	$35
EGA CARD.....	$139
2 WAY FDD CONT. (360K).	$49
GAMES CARD.....	$29
AT S/P GAMES CARD.....	$35
4 WAY FDD CONT. (360-1.44M).....	$129
CLOCK CARD.....	$49
SMART DRIVE ADAPTER IDE / FDC.....	$89
SMART DRIVE ADAPTER IDE I/O FDC	$119



386-33 CACHE MOTHERBOARD



- Processor 80386-33
- Cache Controller 882385, 32 Bit Peripheral
- Memory 32KB Cache memory (35 ns)
- Expansion slots: 1 x 32 bit, 3 x 8 bit, 4 x 16 bit
- Intel* Combo Chip set: 82230, 82231
- Shadow RAM
- C&T 82C206 Intergrated peripherals Controller
- LED display for speed indication
- Ability to run OS/2, MS/DOS, XENIX
- Real time clock/calender with battrey back up
- Baby AT* size board
- Reset button Connector
- Keylock button connector
- Speaker connector

X18112.....$2495

386SX 16MHz MOTHERBOARD

- Processor: 80386SX-16MHz (0/1 wait state)
- Co-processor: 80387SX-16 (optional)
- CHIPS & TECH NEAT chipsets
- (SMT) Surface Mount Technology for chipsets & CPU
- Supports up to 2MB on board, (Sixteen 44256 and Eight 41256 sockets)
- Three 8 BIT slots • Five 16 BIT slots
- Memory Expansion Slot
- Optional 2-8MB memory card
- Supports LOTUS-INTEL-MICROSOFT (LIM) Expanded Memory Spec. (EMS) version 4.0
- Supports Page Interleave Mode using 100NS DRAM
- BIOS: AMI or PHOENIX
- Turbo Light and Hardware Reset connector
- Keyboard or Hardware Reset connector
- Power Good Signal on board • Baby size main board

X18094. OK RAM..... $695

SUPER BUS MOUSE 2

The new Z-NIX Super mouse 2 allows you to get the most out of your computer and enhance your productivity. It gives you the ability to expand the versitility of your computer through the use of graghic software such as paint, draw and CAD programs. The super mouse 2 allows you to run programs like GEM and Windows which makes al operations of the computer easier and faster. Many popularSpreadsheets, databases, word processors and other programs can also be worked with the Super Mouse 2.
- 100% Microsoft Compatible
- IBM or APPLE Family Computer Compatible.
- Free Software with Pop-up Menus
- Life time Warranty

Also supplied with the Super Bus Mouse 2 are 2 FREE Telepaint disks which allows the user to perform high resolution graphics with the mouse.

X19951.....$119

008 335757 TOLL FREE MAIL ORDER HOTLINE FOR CREDIT CARD ORDERS!

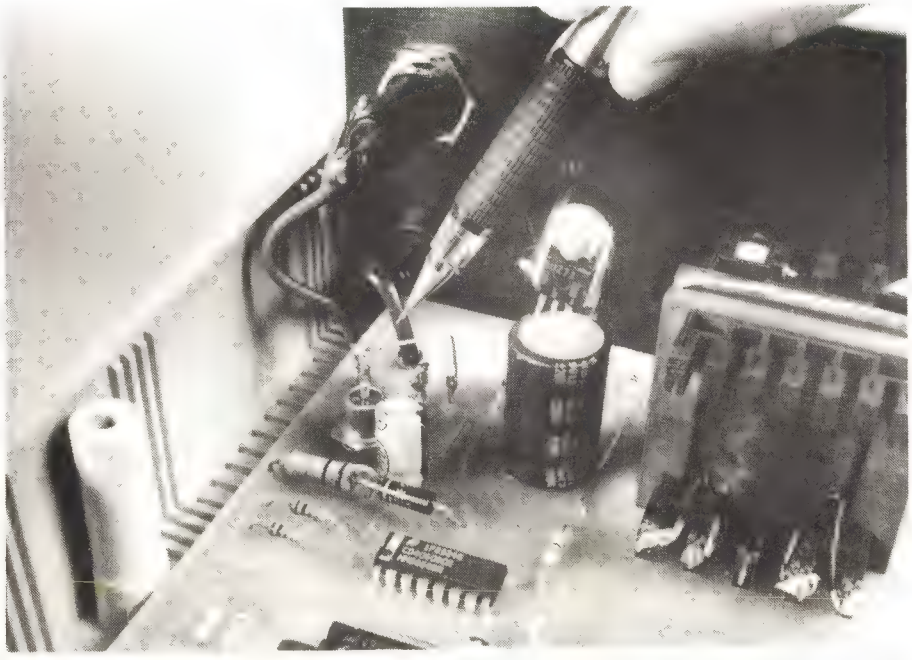
FAST CHARGER NICAD BATTER

Last month, we introduced our new Fast Nicad Charger & described the circuit. In this issue, we give you all the construction details.

By JOHN CLARKE & GREG SWAIN

Despite the circuit complexity, this project is very easy to build and there are just two simple adjustments. Most of the parts are mounted on a single large PC board coded SC14101911 (167 x 222mm) and this is housed in a plastic instrument case. A large finned heatsink is bolted to the metal rear panel and this provides heatsinking for the Mosfet switching devices (Q1-Q4) and for the rectifiers (D4 & D5).

Begin construction by checking the copper pattern of the PC board for any shorts between tracks or open circuit tracks (compare it with the published pattern). A quick check at this stage can save hours of troubleshooting later on.



This close-up view shows how power diode D1 is mounted. Be sure to install the star washer on the copper side of the board, as this bites into the copper pattern & ensures good electrical contact. Note also the stress loop in one of the leads from zener diode ZD1. The other zener diodes are installed in similar fashion.

Fig.7 shows the parts layout on the PC board. Before installing any of the parts, check that the board mounting holes are large enough to accept the self-tapping mounting screws. Similarly, check the mounting holes for diode D1 and for the transformer (T1).

Begin the PC board assembly by installing PC stakes at all the external wiring points, then install the wire links, diodes and resistors. Be sure to use the correct diode at each location and check that they are all installed the right way around. It's a good idea to install the zener diodes with a loop in one of the leads (see photo) to relieve any stresses due to thermal expansion.

The two 0.22Ω 5W resistors should be stood off the board by about 2mm so that air can freely circulate beneath them for cooling.

This done, install the ICs, small signal transistors and the stud-mount diode (D1). Be sure to install the star washer for D1 on the copper side of the board, as this "bites" into the copper pattern and ensures a good contact. The electrolytic capacitors can now all be installed, followed by the four Mosfets (Q1-Q4) and the two power diodes (D4 & D5). These last six components should all be mounted at full lead length.

Inductors

Inductors L1 and L2 are each wound using 9 turns of 1.25mm enamelled copper wire (ECW) on the same Neosid iron powder toroid. These windings are wound on opposite sides of the toroid and in opposite directions to each other (see Fig.7). Scrape

FOR ES

Pt.2: The Construction Details

The Nicad Fast Charger features a very reliable automatic switch-off circuit when operated in fast-charge mode. This prevents overcharging which could ultimately lead to expensive cell damage.

he enamel from the ends of the windngs and tin them before installing he unit on the PC board.

Winding the transformer

The transformer is supplied as a obbin with two E cores, one for the op and the other for the bottom. hese cores are held together with a J-shaped clamp which is installed fter the transformer is wound.

Now take a look at Fig.6. This shows ow the primary and secondary windngs are terminated on the transformer obbin. Note that the 4-pin side of the obbin terminates the primary leads, while the 5-pin side is for the secondary windings.

To wind the primary, you will need -metre of 1.25mm ECW. First, scrape he enamel from one end and solder to the S1 pin. Now, starting from he bottom, wind on 8.5 turns in a lockwise direction, with the windngs laid side by side as you progress up the transformer bobbin.

When you have wound on the 8.5 turns, run the lead directly down the side of the bobbin (ie, at right angles to the winding), trim to size and terminate the end on the F1 pin. Wrap a layer of insulating tape tightly around the winding to secure the turns firmly in place.

The other half of the primary winding starts at S2 and is wound in the same direction directly over the top of the first. Wind on 8.5 turns as before and terminate this winding on the F2 pin. Another layer of insulating tape is then used to secure this winding.

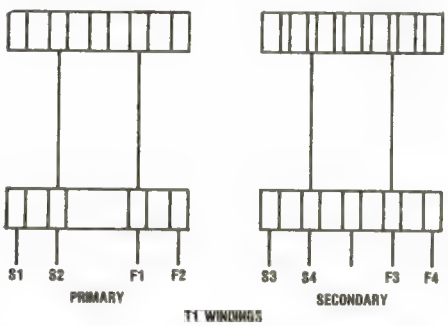


Fig.6: the transformer windings must be terminated exactly as shown here, otherwise the inverter circuit won't work. Step-by-step winding details are given in the text.

The two secondary windings are wound in exactly the same manner, except that each winding consists of 17.5 turns. Begin the first winding at the S3 terminal, wind on 17.5 turns of 1.25mm ECW and terminate at the F3 pin. Secure this using another layer of insulating tape then, starting at S4, wind on another 17.5 turns and terminate this winding at F4.

Install a final layer of insulating tape to secure this last winding, then fit the top and bottom cores to the bobbin and clamp the transformer assembly to the PC board. Tighten the clamp nuts firmly but don't overtighten them, otherwise you'll crack the ferrite cores. Finally, solder the various transformer pins to the PC pattern.

RESISTOR COLOUR CODES

No.	Value	4-Band Code (5%)	5-Band Code (1%)
1	2.2MΩ	red red green gold	red red black yellow brown
1	470kΩ	yellow violet yellow gold	yellow violet black orange brown
2	220kΩ	red red yellow gold	red red black orange brown
5	100kΩ	brown black yellow gold	brown black black orange brown
2	47kΩ	yellow violet orange gold	yellow violet black red brown
1	33kΩ	orange orange orange gold	orange orange black red brown
1	22kΩ 1%	not applicable	red red black red brown
1	20kΩ 1%	not applicable	red black black red brown
1	15kΩ	brown green orange gold	brown green black red brown
12	10kΩ	brown black orange gold	brown black black red brown
1	6.8kΩ	blue grey red gold	blue grey black brown brown
2	4.7kΩ	yellow violet red gold	yellow violet black brown brown
2	4.7kΩ 1%	not applicable	yellow violet black brown brown
5	3.3kΩ	orange orange red gold	orange orange black brown brown
1	1.5kΩ	brown green red gold	brown green black brown brown
3	1kΩ	brown black red gold	brown black black brown brown
1	820Ω	grey red brown gold	grey red black black brown
1	680Ω	blue grey brown gold	blue grey black black brown
2	47Ω	yellow violet black gold	yellow violet black gold brown
4	10Ω	brown black black gold	brown black black gold brown
1	1Ω 1W	brown black gold gold	brown black black silver brown
2	0.22Ω 5W	not applicable	not applicable

The PC board now can be fitted into the case. Note that it will be necessary to trim the threaded portion of the stud-mounting diode using a hacksaw so that it doesn't foul the bottom. In addition, some of the internal pillars will have to be shortened using an oversize drill so that they don't foul the board.

Installing the Mosfets

Once the PC board fits correctly, you can mark out the mounting positions for the Mosfets and power diodes on the heatsink and rear panel. Note that the two outside Mosfets (Q1 & Q4) mount on 93mm centres so that their mounting screws fit between the fins of the heatsink. The two inner Mosfets, Q2 & Q3, are on 27mm centres so that their mounting screws intercept the flat area between the two sets of heatsink fins.

Note: if you use a different heatsink to the one specified, you will have to adjust the positions of the mounting holes accordingly.

It's best to mark out and drill the holes in the heatsink first and then use this as a template for marking out the Mosfet mounting holes in the rear panel. Position the four holes so that they are 28mm from the bottom of the heatsink and make sure that the heatsink is centred vertically on the rear panel so that it clears the top and bottom panels of the case. The holes for the two power diodes, cordgrip grommets and the fuseholder can also be marked out on the rear panel at this stage.

After drilling, carefully deburr all holes using an oversize drill to ensure a smooth mounting surface for the transistors and diodes.

The four Mosfet transistors and the two power diodes (D4 & D5) must be insulated from the case using mica washers and insulating bushes. Fig.8 shows the mounting details. Smear heatsink compound on the mating surfaces before screwing each assembly to the rear panel and note that it may be necessary to bend the leads of each device slightly so that it lines up with its mounting hole.

As each device is mounted, use your multimeter to confirm that its tab has been correctly isolated from the rear panel. If you do get a short

CAPACITOR CODES

Value	IEC Code	EIA Code
0.1µF	100n	104
.022µF	22n	223
.01µF	10n	103
.001µF	1n	102

circuit, clear the problem before pro ceeding further.

Final assembly

If you don't already have a pre drilled front panel, you will have t use the accompanying artwork or self-adhesive label as a drilling tem plate. If you have a self-adhesiv label, it's best to attach this to th front panel before drilling the holes.

Drill small pilot holes for th switches initially, then carefully rea them out to the correct size with tapered reamer.

Once this has been done, you ca mount the switches and LEDs an complete the wiring as shown i Fig.7. All wiring to the front pane

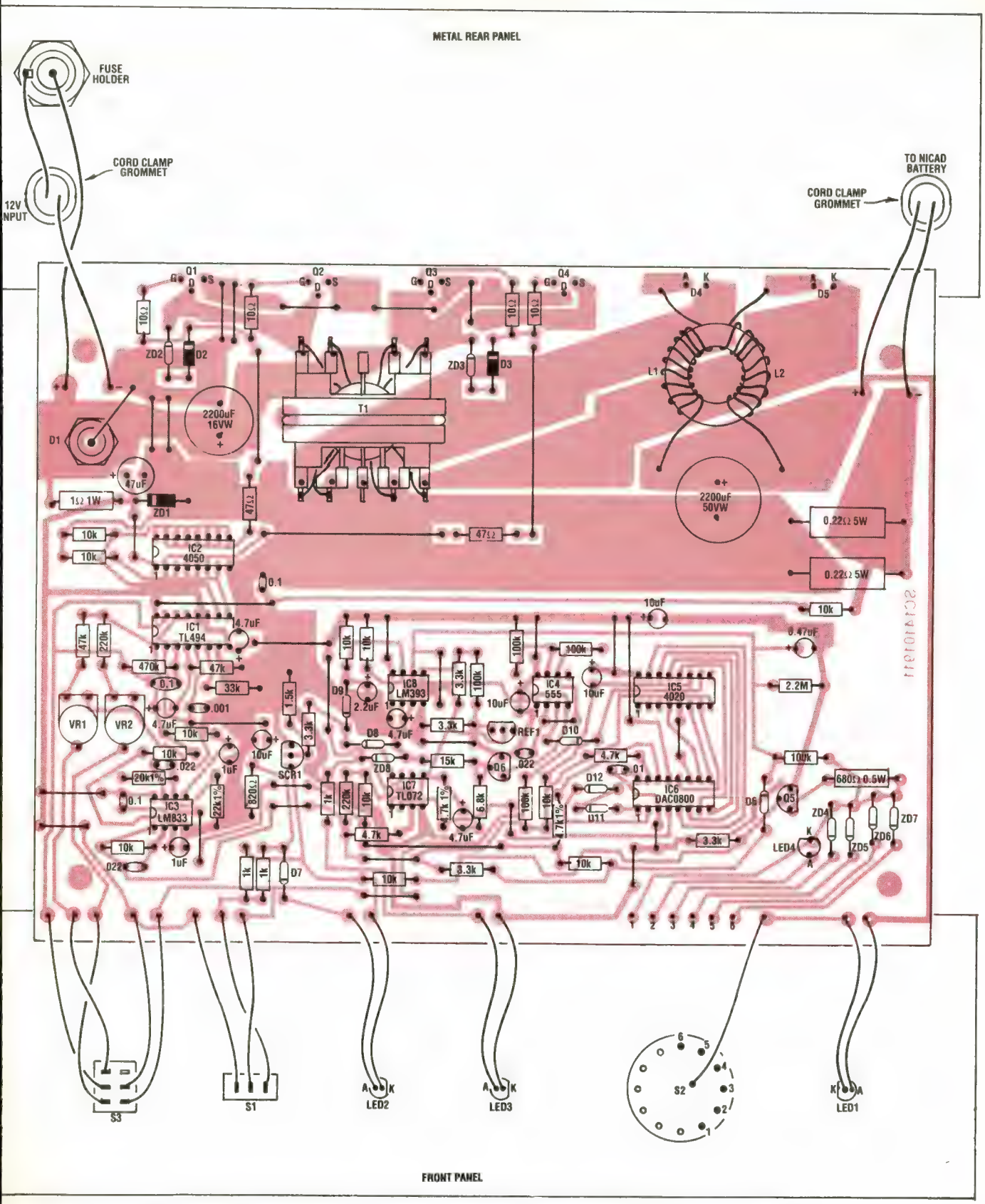


Fig.7: check that all polarised components are correctly oriented when mounting the parts on the PC board. Be sure also to use the correct transistor type & zener diode at each location. The pinouts for the Mosfet transistors (Q1-Q4) & the two power diodes (D4 & D5) can be obtained from the main circuit diagram (Fig.5). Note that the metal tabs of these parts must be electrically isolated from the metal rear panel, as shown in Fig.8. The front panel wiring can be run using light-duty hookup wire but use heavy-duty (10A) cable for all rear panel wiring.

The four Mosfet transistors and the two fast recovery diodes (D4 & D5) are all soldered directly to the PC board at full lead length & then bolted to the metal rear panel using TO-220 insulating kits. Check that the mounting surfaces are smooth & free of metal swarf before installing these devices.

can be run using light-duty hookup wire but be sure to use heavy-duty (10A) wire for all wiring to the fuseholder, 12V battery and nicad battery.

The leads to the 12V battery can be fitted with large automotive battery clips while the output leads should be fitted with a polarised socket to match the plug on the battery pack.

Testing

Initially, set VR1 and VR2 about 90% anticlockwise, set the Fast/Trickle switch to FAST, and set the Battery Select switch to 6V. Now connect a 12V power supply and check for the correct supply voltages on all the ICs. Check also that the pin 1 output of IC3a is at +5V and that the pin 7 output of IC3b is at +9.55V.

If you strike problems, switch off immediately and clear the fault before proceeding further.

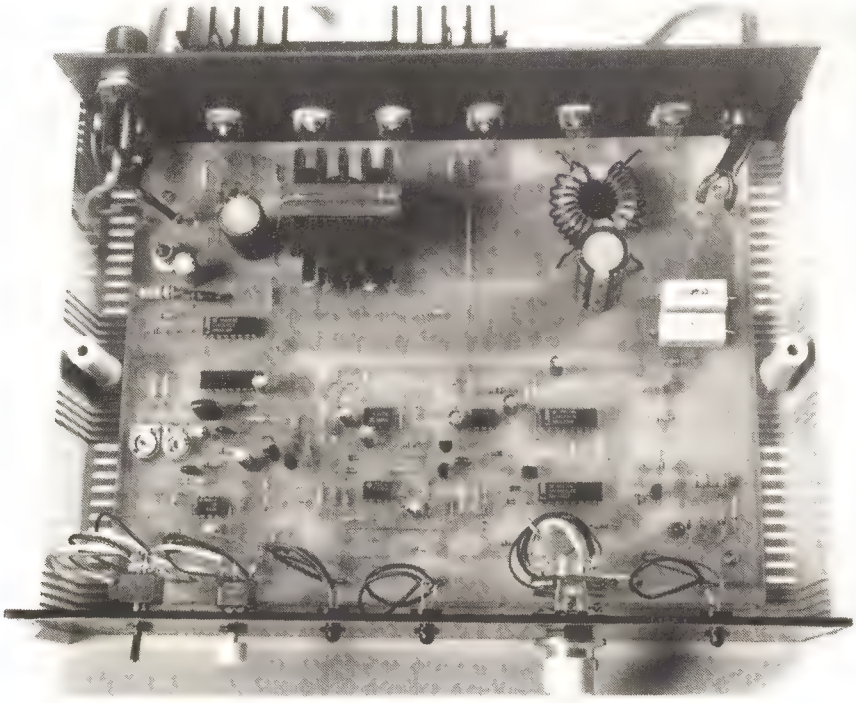
If everything is OK, press the Start switch and check that the Charging LED lights. This LED should then extinguish after a few seconds and the Error and End Of Charge LEDs should come on.

Now disconnect the power supply and connect the unit to a 12V car battery. Press the Start switch again and immediately check the output voltage of the charger (ie, check across the output leads to the nicad battery). You should get a measurement of about 24V or higher, since the output terminals are open circuit.

Now short the output terminals, press the Start switch once more and check the voltage across the paralleled 0.22Ω 5W resistors. Adjust VR1 for a reading of 0.66V. This sets the charging current to 6A.

Similarly, switch to Trickle charge and adjust VR2 to set the standard charge rate for your nicad cells. For 1300mAh cells, this will be 130mA (ie, C/10). This means that the voltage across the 0.22Ω resistors must be set to 14mV (ie, V = IR where I = 130mA and R = 0.11Ω).

At this stage, your Nicad Fast Charger is ready for work but a few final checks are in order. Connect the charger to a discharged battery pack, select fast charge and the appropriate voltage range, and press the Start button to begin charging. Now check that the voltage across the 0.22Ω resistors



The PC board is secured to integral plastic standoffs moulded into the bottom of the case. Note that it will be necessary to cut off part of the threaded portion of the stud-mounting diode so that the board will fit.

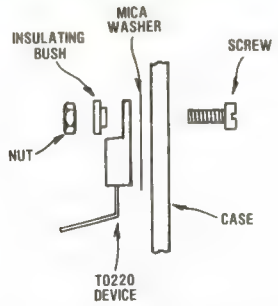


Fig.8: mounting details for the Mosfet transistors & fast recovery diodes. Smear all mating surfaces with heatsink compound before bolting each assembly together.

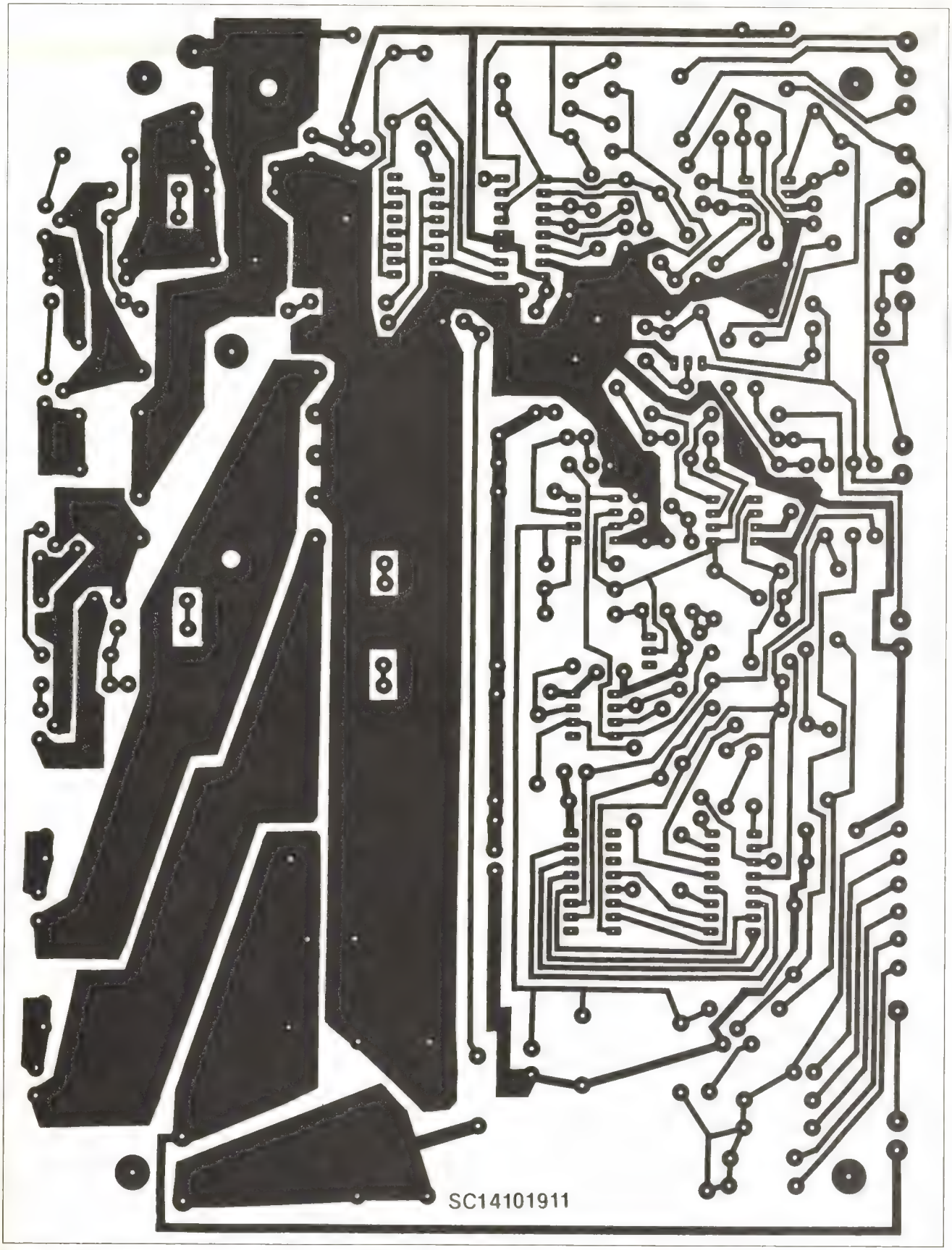
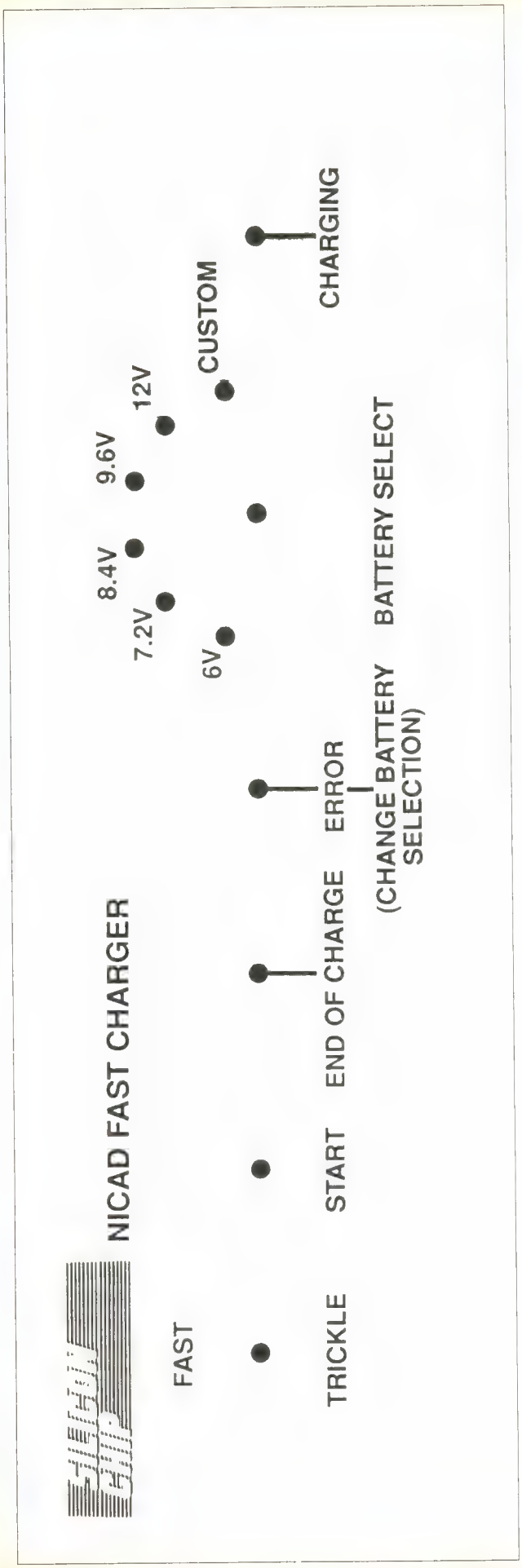


Fig.9: this is the full size artwork for the PC board. It is a good idea to carefully check this pattern against your etched board before mounting any of the parts, as it is easier to spot any errors at this stage. In particular, check for breaks in the copper pattern & for shorts between adjacent tracks.



The output leads should be fitted with a polarised plug to match the battery pack. This will prevent you from connecting the leads the wrong way around.

is still 0.66V. Also, check the voltage across the nicad bat tery pack - it should gradually rise towards its final end point voltage of about 1.8V per cell.

While the battery pack is charging, check that the DAC output follows the battery voltage by monitoring pin 1 o IC7. This should rise as the nicad battery voltage rises Similarly, check that pin 5 of IC8 is 80mV less than pin 1 o IC7.

Finally, continue monitoring the nicad battery voltag until it reaches a plateau and begins to fall. The charge should automatically switch off as soon as the battery volt age falls 80mV below its peak value.

Custom cell packs

The custom selection on the Battery Select switch i provided for special applications; eg, you may want t charge 24 cells in series. As stated earlier, this involve winding more turns on the secondaries of the transforme In addition, you will have to choose a value for ZD7 (se Fig.5) to suit your particular application.

When winding the transformer, you have to provide a least enough turns to give 1.8V per cell. This means that fo 24 cells, enough turns must be wound on to give 44V.

In this design, each turn on the secondary gives abou 1.38V. Thus, a 44V output requires 32 turns, to which w add an extra three turns to provide a reasonable margi This brings the total to 35 turns on each half of the secon dary (ie, an output of about 48V). Note that you will no have to use 0.8mm ECW instead of the 1.25mm wire so tha the windings will fit on the bobbin.

ZD7 is selected so that the voltage fed to pin 3 of IC8a i less than 8V when the cells are fully charged. For 24 cell we expect 44V and from this we can subtract the 1.8V dro across LED 1. Thus, 44 - 1.8 - 8 = 34.2V, which means tha ZD7 can be a 35V 1W zener diode.

Finally, note that the charging current cannot now b adjusted for 6A, as the maximum power that the charger ca deliver is limited to 100W. In this case, you will have t settle for a current of about 2A (ie, 100W/48V = 2.08A). S

Fig.10 (left): this artwork can be used as a drilling template for the front panel. You can also use it to make up your own artwork if you don't wish to purchase a commercial panel.

CTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELEC

JAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICS

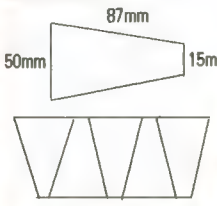
SOLAR CELL BARGAIN

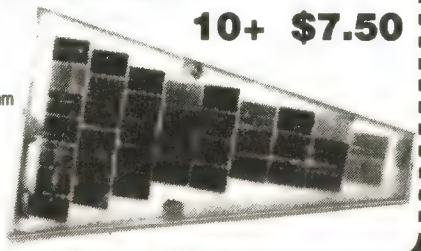
ONLY $7.95

Super high quality 12V 10mA cell. It sits in an aluminium case with perspex cover and is epoxy sealed. Two pins 15mm long on rear are for easy mounting and they have 180mm cables for connecting. See diagram for shape, they will sit next to each other (every 2nd one reversed for easy mounting).

Cat. ZM-9002

10+ $7.50





75Ω COAX BARGAIN

AIR SPACED COAX AT $35 100MT ROLL

Yes, that's correct. High quality Benelec brand 0.65mm conductor, airspace PE dielectric, foil shield, 5mm OD sheath, brown in colour air space, 75Ω coax. Save a fortune over normal prices. 70¢ mt for quantities less than 100mt roll.

Cat. WB-2002

$35 - 100 mt roll

240 VOLT RELAYS AND BASES

Power Relay

At last, 240V AC, high current relays now available from Jaycar.

Contact form:
DPDT
Contact rating:
10A
Voltage:
240V AC
Current:
4.8/5.3mA
Resistance:
18,790ohm
Must operate voltage:
80% max
Must release:
30% min
Max voltage:
110%

Cat. SY-4063

$12.50

10+ $12

Base to Suit

High quality, DIN rail mount, screw terminals base to suit power relay.

Size 72(L) x 29(W) x 30(H)mm.

Cat. SY-4064

Special price

$4.95

10+ $4.50

NEW

240 Volt Octal Relay

Industrial type 240V AC, 10A Octal Relay now available and they are well below normal price.

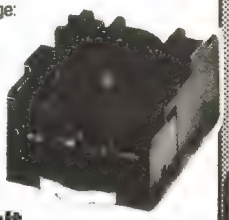
Specifications
Coil ratings
Voltage:
240V AC
Current:
9.2mA
Contact current rating:
10A
Coil resistance:
6737Ω
Must operate voltage:
80% max
Must drop out voltage:
25% min
Permissible voltage:
90/100%
Power consumption:
2.7VA

Cat. SY-4022

$15.95

+ $15

Base to Suit



High quality, DIN rail mount, screw terminals.

Size 59(L) x 40(W) x 21(H)mm.

Cat. SY-4021

$6.95

10+ $6.50

NEW

SWITCHMODE POWER SUPPLY

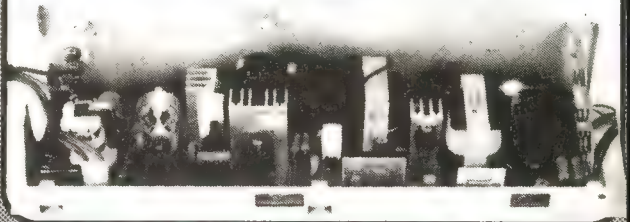
Unbelievably cheap, but there's a catch!

We have obtained a quantity of new (removed from brand new equipment) computer switchmode type power supplies. We offered a smaller version in May 1990 and they went
incredibly quick. This supply is in a case, has a quality 250V 4A rocker switch mounted on a
metal bracket, IEC input socket and lots of power supply compenents.
Typical outputs wil be +5V around 2A, +12V and -12V low current, and 12V around 2A. Made in Japan.
The problem is that they are 110V powered not 240V. You can use then for parts at this bargain price.

Size 300(L) x 65(H) x 90(D)mm

ONLY $14.95

Cat. MP-3000



VIATEL Units Slashed Further

You've probably seen our ads recently for VIATEL units at crazy prices. Well - to clear them out, we've slashed the price even further. These terminals enable you to connect your phone (some models even have phones supplied), TV or RGB colour monitor to set up a VIATEL in your home or office. Just think, you can access all of that fantastic information on VIATEL without having to pay a fortune for an expensive terminal. You will still need to pay the VIATEL service fee of course! Each videotex terminal contains a fully Telecom approved modem and all electronics to decode VIATEL signals and display them on your TV or RGB monitor. Three models are available:

Model #1

(The cheapest) Features full console, numeric keypad (for entering into and operating the Videotex system) RF out (to your TV) but no phone. You can plug any phone into the socket, provided of course, the phone is only used to access the Videotex number anyway (some phones can be used as keypads, however). This machine is all you really need.

Cat. YV-7075

Was $29.95 NOW $19.95

Model #2

Identical to Model #1 but with a dedicated phone which can be used as a keypad.

Cat. YV-7076

Was $34.95 NOW $22.95

Model #3

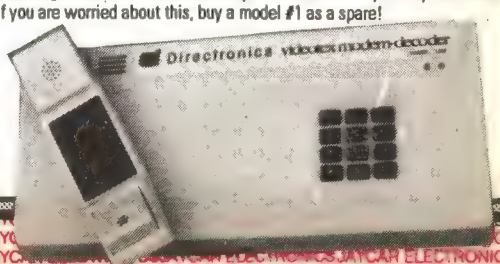
As per model #1 but with RF and RGB video output (for better quality on a suitable RGB colour monitor)

Cat. YV-7077

Was $34.95 NOW $22.95

Worth around $250 less than a few years ago!

Note: All models are brand new in cartons with instructions. They are worth far more than this for the parts alone. They contain valuable Philips SAA5020 and 5050 chips because we are selling these at such a ridiculously low cost, warranty is only one month from receipt. If you are worried about this, buy a model #1 as a spare!



PCB RELAY SENSATION

We have purchased a large quantity of DPDT 12V, 3A, high quality Japanese made Omron PC mount relays. These are Telecom approved, plastic sealed with bifurcated crossbar contacts. They conform to International 2.54mm terminal pitch and have a life expectancy of 100,000,000 operations. You would expect to pay around $10 each for these.

Specifications
Voltage DC - 12V
Current - 24mA
Resistance - 500Ω
Contact rating - 3A

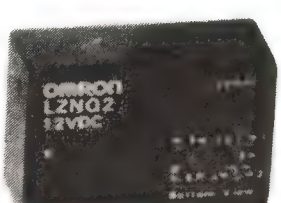
SAVE UP TO 80%

Cat. SY-4055

NEW

Buy up now and save a fortune

1 - 9	**$2.95 ea**
10 - 99	**$2.50 ea**
100+	**$2 ea**



JAYCAR
WILL NOT BE UNDERSOLD
WE WILL BETTER ANY ADVERTISED PRICE ON GOODS OF THE SAME QUALITY

PC Board Madness

Double sided fibreglass PC board at about half normal price. Size 365 x 210mm

Cat. HP-9520

Normal price $14.95

NOW ONLY

$7.95 10+ $7.50

JAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICS

ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR

CSJAYCAR ELECTRONICSJAYCAR ELECTRONICSJAYCAR ELECTRONIC

PRODUCT SHOWCASE

Portable PC has automatic power save

Sanyo has just released the MBC-17NB "Notebook" portable PC. It has an inbuilt 20Mb hard disc drive and a floppy drive as well. The display is a backlit blue LCD panel which is claimed to be NCQ - near colour quality. As well, there is a standard port for connection of a full size VGA monitor, quite desirable for those users who want a portable but need the good quality display.

The automatic power save lets the user nominate a time delay up to 127 minutes, after which the power to LCD screen, keyboard and hard disc is suspended without affecting the work currently being processed. The clock speed is also dropped to 6.5MHz to conserve the batteries. When the batteries do discharge, they can be fully recharged within one hour.

Sanyo says the MBC-N17B outperforms some 386SX machines. It features an 80C286 processor and 1Mb standard memory expandable to 5Mb.

There is also an IDE connector and an optional internal modem.

For further information, contact Sanyo Office Machines Pty Ltd, 384 Eastern Valley Way, East Chatswood, NSW 2057. Phone (02) 498 2799.

Midi system has CD player & Dolby noise reduction

These days, if you are looking for a good midi-sized hifi system under $1000, you will almost always find that the cassette deck does not have Dolby noise reduction. This is ludicrous really since all recorded music cassettes feature Dolby. However, this new release from Akai does have Dolby.

The Akai M-393 features a power amplifier cum graphic analyser rated at 30W per channel, although by some imaginative mathematics they manage to claim that it can deliver 600W peak music power.

One of the nice features about these midi systems is their comprehensive infrared remote control which the Akai M-393 has as standard. It controls most of the wanted facilities and, in particular, the volume level via a motorised volume control.

The AM/FM tuner offers a total of 12 preset stations (six AM and six FM), as well as automatic station scanning. The dual cassette deck offers a continuous listening mode for uninterrupted music and both a normal and high speed dubbing facility. Furthermore, a "synchro" recording feature permits synchronised starts when recording from one tape to another.

The CD player is a 16-bit twice over-sampling digital filter unit with up to 16 program selections. It has all the standard playback features. The record turntable is a 2-speed belt-drive unit (33 & 45 rpm), while the tonearm has a ceramic cartridge and has manual cueing and automatic return at the end of play.

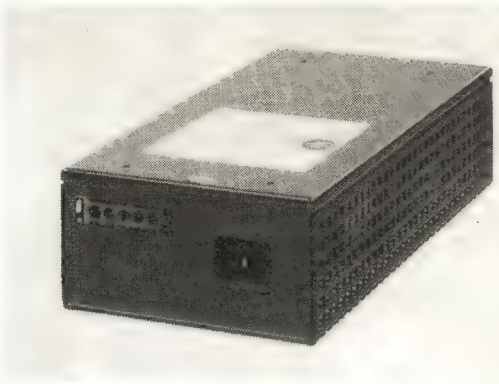
Recommended retail price for the Akai M-393 is $899 and it has a 12-month warranty. For further information, contact your local Akai hifi dealer.

Battery eliminators for communications gear

Melbourne based manufacturer Setec has available two power supplies that also double as battery chargers. The model BCE1 has a 13.65V regulated DC output at currents up to 10 amps. The model BCE2 supply provides a 27.6V rail for powering 24V equipment at currents of up to 5 amps.

Both supplies are switchmode types with high efficiency, low noise and compact size. Both are fully protected against overload and output short circuits.

With communications equipment and a battery connected to the supply, the installation gives a measure of power fail protection. Under normal conditions, the supply powers the equipment and float charges the battery. Then, when the mains power fails, the battery supplies the equipment but it will be disconnected before it is heavily discharged. This ensures longer battery life and allows the equipment to run unattended with a minimum of service calls.



Each unit is available in panel mount, rack mount or PC board versions and all come with a 5-year warranty. For further information, contact Setec Pty Ltd, 6 Holloway Dr Bayswater, Victoria 3153. Phone (03) 762 5777.

IEEE-488 controller board for the Mac

This board, from Elmeasco Instruments, will turn your MacIntosh SE/30 into an IEEE-488.2 bus system, capable of transferring data at rates up to 1Mb/sec.

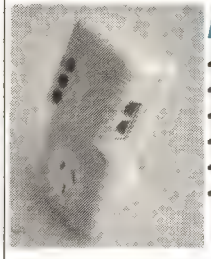
It can control up to a maximum of 14 separate devices or instruments. Applications for this can include laboratory testing, production testing and process monitoring, as well as communicating with engineering, scientific and medical equipment.

The board itself uses Turbo488 and NAT4882 custom chips. These are designed for the job and are extremely reliable.

The unit comes with National Instruments Corporation's NI-488 software driver for the Mac system and requires no configuration jumpers as it's all done by software.

For further information, contact your nearest Elmeasco office or phone Sydney (02) 736 2888 or Melbourne (03) 879 2322.

PHONE LINE AND MAINS FILTER/SURGE PROTECTOR



Protection for

- *Answering machines*
- *Cordless phones*
- *Facsimiles*
- *Computers*
- *Modems*
- *Telex*

The Arista model CPEP-1 ensures that lightning, power surges and spikes do not reach your costly equipment as it communication constantly monitors the PHONE line and the MAINS power line. Simply connect to any existing power point, plug in your fax, phone, video, Hi Fi or any other 240 VAC operated equipment and a series of indicators shows the status of the mains power point while several MOV's and gas arrestors prevents access to damaging energy sources. The CPEP-1 is fully Telecom and Dept. of Minerals and Energy tested and approved.

Imported and distributed by:

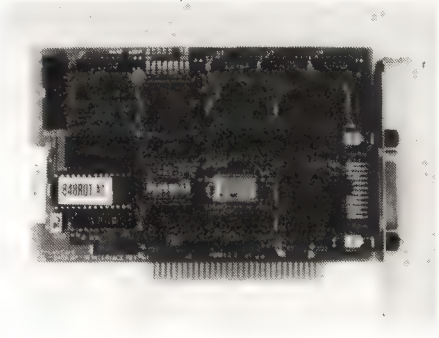
ARISTA ELECTRONICS

Available through the following retailers:

Telegrafax P/L. 305-307 Sailors Bay Road. Northbridge. 2063. NSW. (02) 958 5137

Geoff Wood Elec. 229 Burns Bay Road. Lane Cove. 2066. NSW. (02) 427 1676.

Industry standard IEEE-488 interface card

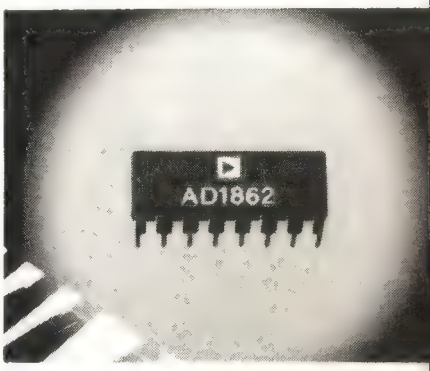


Electronic Solutions has just released an industry standard IEEE-488 card which is one of the cards available to implement the entire IEEE-488 standard. It provides all the hardware to interface a PC to the IEEE-488 bus and has all the software in ROM. Complete documentation is provided, so that programming for special applications can be done.

No additional operation is required for operation with Basic or Turbo Pascal while Basic A, Basic Compiler and Quick Basic are supported as standard.

For further information, contact Electronic Solutions, 5 Waltham St Artarmon, NSW. Phone (02) 906 6666 or fax (02) 906 5222.

Monolithic 20-bit D/A converter

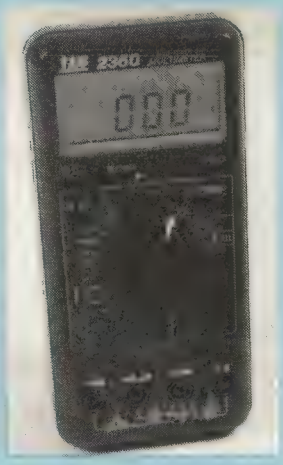


Analog Devices Inc has announced the first monolithic 20-bit digital to analog converter designed specifically for high performance digital audio applications such as electronic musical instruments.

Measured according to EIAJ standards, the AD1862 achieves a signal to noise ratio of 119dB and 96dB (.0016%) total harmonic distortion + noise (THD+N), and a minimum dynamic range of 102dB. Gain linearity is very good with an error of ±1dB at -90dB.

Packaged in a 16-pin DIP, the monolithic converter employs proprietary digital offset circuitry to enhance low

DMM checks inductance, frequency & temperature



This 4000 count multimeter, the TES 2360, measures just about everything ever found on a multimeter except perhaps for transistor beta. As well as measuring the normal volts AC & DC, AC & DC current up to 10 amps and resistance up to 40 megohms, it has four ranges each for capacitance and inductance. In fact, it is the first multimeter we have come across with inductance ranges.

Its inductance ranges are 4 millihenries, 40mH, 4 Henries and 40 Henries, making it a very useful instrument just for these ranges alone.

As well, it will measure frequency and temperature, both Fahrenheit and Celsius.

A Jaycar Electronics import, it is well worth considering at $179.00.

evel signal linearity and eliminate he need for deglitching circuitry. An external midscale trim pin is provided or applications requiring the best possible distortion performance for small signal amplitudes (<60dB).

For further information, contact the distributor for Analog Devices, NSD Australia. Phone (03) 890 0970.

Probe for dielectric measurements

Hewlett Packard has introduced a dielectric probe kit that simplifies measurements of materials used in the food, chemical and electronics industries. The HP 85070A kit includes a probe and software, designed to work with a network analyser and computer. Together they form a system that measures the complex permittivity, including the dielectric loss factor of materials at radio and microwave frequencies.

To measure liquids or semi-solids, the probe is immersed into the sample. No special fixtures, containers or sample preparations are required.

For solids, a smooth flat surface on the material is required for contact with the probe.

The system then measures parameters as a function of frequency. Frequency coverage is determined by the material properties, the network analyser and the probe, which operates up to 20 Gigahertz.

The HP 85070A comes as standard equipment with PC-compatible software running under Microsoft Windows. The kit is priced at $6600.. Complete systems, including network analyser, computer and probe kit, start at $59,000..

For further information, contact Hewlett Packard Australia Ltd, 31-41 Joseph St, Blackburn, Vic 3130. Phone (008) 033 821. SC

RCS RADIO PTY. LTD.

RCS Radio Pty Ltd is the only company which manufactures and sells every PCB & front panel published in SILICON CHIP, ETI and EA.

651 Forest Road, Bexley, NSW 2207. Phone (02) 587 3491.

ELECTRONICS WORLD

SPECIALS

USED 'AA' 700mAH NICAD BATTERIES	$ 0.50
TEMPERATURE CONTROLLED SOLDERING STATION	$135.00
UNIVERSAL NICAD BATTERY CHARGER Can do 4 at a time (AA, C, D, or 9V Nicads)	$ 29.95
40 CHANNEL AM CB RADIO	$ 79.00
SMOKE DETECTOR	$ 49.95
PIEZO SIREN WITH BACKUP BATTERY Ideal for Car Alarms	$ 59.95
DIGITAL DISPLAY AM/FM STEREO CAR RADIO	$ 49.95
PORTASOL GAS SOLDERING IRON	$ 35.00
ARLEC SUPER TOOL KIT	$ 69.50
LOGIC PROBE	$ 35.00
SCANNER FANATICS FREQUENCY REGISTER OF VIC.	$ 24.95
PHILIPS INFRARED REMOTE CONTROL	$ 35.00
COMMON CATHODE 7-SEGMENT DISPLAY	$ 1.00
VIDEO DUBBING KIT	$ 15.95
ARLEC 2 SPEED CORDLESS DRILL AND SCREWDRIVER	$ 69.95
2-CHANNEL FM WIRELESS INTERCOM	$ 89.95
SINGLE CHANNEL UHF TRANSMITTER KIT	$ 18.00
SINGLE CHANNEL UHF RECEIVER KIT	$ 34.90
VULTURE CAR ALARM KIT	$ 39.90
INFRA RED NIGHT VIEWER KIT	$239.00
TALKING ELECTRONICS ULTIMA FM BUG KIT	$ 12.50

Mail Orders Welcome

30 Lacey St, Croydon
VIC, 3136.

Telephone: (03) 723 3860
(03) 723 3094
Fax: (03) 725 9443

SERVICEMAN'S LOG

Now look what ya gorn an' done!

We don't hear that expression much these days but it was a popular one years ago. It was reserved for those occasions when someone committed a careless act which resulted in serious - and sometime irretrievable - damage. These days we tend to use the more economical expression, "Oops".

Either way, the implication is the same; somebody has goofed and done a lot of unnecessary damage in the process. And since we have all done it at times, it doesn't do to be too cocky when someone else does it. But we can take heed and be warned.

I have two such stories this month. One situation was retrievable, even though it looked a bit sticky for a while. The other one ... ?

The first story concerns a Hanimex 18cm monochrome TV set, model HTV7. It was a brand new set, belonging to a colleague who is one of the local antenna installers and with whom I work quite frequently. The set was bought specifically for this job, to be used when doing survey work in difficult areas, particularly involving SBS on UHF.

It could operate from either the 240V AC mains or a 12V battery. In the latter mode, it used a lead fitted with a lighter plug at one end and a so-called DC plug at the other, this mating with a PC board socket in the set.

For those who may not recognise the DC plug by that name, a brief description might help. The best alternative term that comes to mind is a female plug - a contradiction in terms perhaps, but that is what it is; a plug shaped device for lead termination which is, in the conventional sense, a socket. And the male mating device, designed more like a socket for chassis or PC board mounting, is in the conventional sense a plug.

While these devices are not often found in everyday TV and video equipment, they are used extensively on plugpacks, small chargers for nicad battery operated devices, and such like. (An article in an English technical magazine some years ago suggested that, in order to avoid confusion, such devices should be referred to as "sugs" and "plockets". Fortunately, the idea did not catch on).

Anyway, battery operation was one of the main advantages of this devic and the owner had purchased a smal sealed lead-acid 12V battery to go wit it, making the whole assembly com pact enough to carry around with a exploratory antenna, even onto a roo if necessary. To accommodate thi battery, he had removed the cigarett lighter plug, shortened the lead some what, and bared the ends to fit th screw terminals on the battery.

Which was all very clever and logi cal. Except that this was where h came to grief. The original lead wa fitted with a fuse and his first mistak was to remove this from the modifie lead.

His second mistake was confuse th polarity of the battery leads after h had removed the lighter plug. He as sumed - perhaps not unreasonably that the centre connection of the D plug would be positive whereas, ha he taken the trouble to check the orig nal setup, he could have determine that the reverse was the case. In fac there is a noticeable lack of standardi sation in this regard. Some manufac turers favour one arrangement, other the opposite. I'll have more to sa about this later.

The inevitable disaster

So there was a disaster waiting t happen. And, of course, it did hap pen. The first I knew of all this wa when the set was pushed across th counter, together with a brief synop sis of the above events and a plaintiv plea from my colleague. He ha planned to survey a difficult UHF are that morning; could I have a quic look and perhaps get the set going?

He couldn't have picked a wors time. It was a Monday morning an the weekend's pile-up of problem was being unleashed. The phon seemed to be ringing every few min utes and other customers were breas ing the counter. And I didn't eve have a circuit of the set.

Granted, I had a fair idea of what t

TETIA TV TIP

Sanyo CTP5604

Symptom: no sound or picture. Higher than normal voltage appears on the line output transistor collector and a faint squeal can be heard from the power supply circuit board.

Cure: R473 (100Ω 0.25W) open circuit or dry jointed. This resistor is a vital part of the line oscillator and without it the set can never start up. The squeal is the power supply running in its self-oscillating mode, at a much lower frequency than normal.

TETIA TV Tip is supplied by the Tasmanian branch of The Electronic Technicians' Institute of Australia. Contact Jim Lawler, 16 Adina St, Geilston Bay, Tasmania 7015.

look for. Most devices designed for external battery connection use a protective circuit of some kind. The usual arrangement is simply a power diode, reverse connected across the supply leads, so that it is open circuit with correct polarity. Then, in the event of reversed polarity, it is effectively a short circuit, and takes out the aforementioned fuse in the battery lead. Thus alerted, the user can take appropriate action.

But, without a fuse, what would happen? An ohmmeter check confirmed that there was a short across the battery leads, but was this simply a damaged diode, or was it something more serious? I tried running it in the 240V mode but it was just as dead. This tended to confirm my worst fears.

I opened the set with the aim of finding the diode and working from there. But that was easier said than done. There was no diode anywhere near the input socket and my efforts to trace the path through the maze of other tracks on a compact board proved fruitless; it seemed that every time I was half way through a trace there was an interruption of one kind or another.

Finally, even my colleague realised that we were battling against the wind; there was no way we were going to achieve a quick fix in such an atmosphere. The survey would have to be done without it. So I suggested that he leave it with me and go back to the dealer from whom he bought it, and get either a manual or, at least, a circuit. Then, with a more leisurely approach, we might get somewhere. And so I put the set aside.

AJAX AERIALS
©R.TAHURST 91...
HE COULDN'T HAVE PICKED A WORSE TIME~MONDAY MORNING & THE WEEKEND'S PILE-UP OF PROBLEMS... PHONE RINGING & CUSTOMERS BREASTING THE COUNTER...

No circuit

I heard nothing more from my colleague for about three weeks, then he turned up with the news that, after much chasing and duck shoving, he had been advised that Hanimex could not even supply a circuit. So we were on our own.

The owner wasn't particularly happy about the situation. He had spent around $130 for a set which had never been used and now he feared it might be a write-off.

I wasn't that pessimistic but I was worried. While I assumed that there was a protective diode, I wasn't sure. And if there wasn't, the likely damage was anybody's guess.

So, at the first convenient slack period, I tackled the set again. And strangely, without all the pressures of the previous occasion, I found the elusive diode without too much trouble. Of course, it was nowhere near the input socket or on/off switch; I suspect manufacturers do this deliberately.

Anyway, the diode was found, checked, and proved to have a very short circuit! Replacement was simple enough, any power diode with a rating of 1A or better being suitable. Then I set to and re-arranged the customer's lead, clarifying the polarity, and fitting a fuse holder and fuse.

That done, I connected the lead to a 12V battery, crossed my fingers, and switched on. Splat! The fuse went instantly and I thanked my lucky stars I had taken the precaution of fitting it.

But what was wrong? Once again I had horrible thoughts about what damage might have been done with the reversed connection, in spite of the protective diode. Nor was I at all consoled when I put the ohmmeter across the battery leads and found, not the short circuit of a faulty diode, but still a very low resistance, amounting to only a few ohms.

Fortunately, further checking revealed that this low resistance was present even with the set switched off, which left only a short track between the input socket and the on/off switch on the volume control to check. There wasn't much to suspect here. There could, in theory, be a leakage between tracks but this seemed most unlikely. More realistically, the only likely component was the input socket, mounted on the PC board.

Closer examination suggested that it looked somewhat misshapen, so I unsoldered it for a closer look. And it was misshapen all right; in fact, it was well and truly cooked. More importantly, removing the socket had removed the short from the board. Of course, there could be other, more subtle damage yet to be revealed, but I was feeling more hopeful.

This optimism proved to be justi-

fied. I patched a pair of leads directly into the board, connected a battery - with due regard to polarity - and gingerly switched on. And, for the first time, the set came to life; sound immediately and a picture a few seconds later.

Well, that was a relief. No serious damage had been done and all I had to do was fit a new input socket to put the set back into new condition.

Serviceman's goof

Well, this was where I goofed. The simple truth is that I was not as familiar with DC plugs as I thought I was. I had handled them often enough, as part of various pieces of equipment - including some of my own - but I had never had occasion to actually work on them in the service sense.

For a start, I blissfully imagined that I could nip down the street to my local electronics store and purchase a new socket for 80c or so. No dice. They had the plugs and they had mating sockets for lead termination or for chassis mounting, but not for PC board mounting. "Sorry, we don't get much call for them."

No problem really. A phone call to one of my regular bits and pieces suppliers confirmed that they had good stocks. I ordered one and was assured that it would go in the post immediately. And they were as good as their word; it arrived in the mail the next day.

It took only a few minutes to fit it to the board, then I reached for the battery lead to plug it in and give the whole setup a final test. I imagine some readers are way ahead of me; yes, my face was red. I had failed to appreciate that these devices come in two sizes; a 2.1mm pin and a 2.5mm pin.

And, apparently, the 2.5mm version is the more commonly used one so, in the absence of any specifications from me, my supplier had assumed that this was what I wanted. Need I add that the set used the 2.1mm version?

And so it took another phone call, another hastily arranged postal delivery, and another solder job on the board. And that finished the job. But what a chapter of accidents and confusion. As it was, I made only a nominal charge for the job - much less than was really justified. But then, my colleague has done me a few favours and I owed him one.

So everyone was happy, particularly my colleague who had mentally written the set off. But he is also a lot wiser and realises it could have been much worse. Not all devices carry protective circuitry and not all protective circuitry works every time. When you're mucking about with any power leads - even low voltage ones - check and double check the polarity.

Finally, some thoughts on the polarity conventions used with DC plugs. I happened to relate the above story to an amateur friend, including my embarrassment over the DC plug sizes.

He grinned, "Oh yes, I was caught that way myself the first time; it's a common trap." (Now he tells me!)

But he was also able to demonstrate a typical conflict of standards in regard to plug and socket polarity. He produced a popular 2-metre hand held transceiver; a Yaesu Musen model FT-23R which, by all accounts is a very nice little unit.

As is typical of such devices it operates from a slide-on nicad battery pack, 7.2V in this case, although a 12V pack is available. The pack is fitted with a 2.1mm phono socket (not exactly the same as the DC plug, but similar) which accepts a plug from a charger. And moulded into the case is a schematic portrayal of the socket with polarity markings clearly indicating that the centre conductor which becomes the tip of the plug should be positive. Fair enough.

As well as the battery pack proper there is also a dummy battery pack available as an accessory. It is similar to the real one but empty, its purpose

eing to provide access to an external ower source, such as a car's 12V sys- em. This is fitted with the same type f socket to take the lead from this ource - except that (yes, you've uessed it) this connection uses the pposite polarity.

Why this distinction? I have no dea. As far as I can see, there is no dvantage one way or the other. Nor oes it matter, provided the differ- nce is appreciated. But wouldn't here be less chance of accidents if oth connections were the same?

Anyway, that's my "Oops" for the onth. But here's another one from y regular contributor, J.L. from over- eas in Tasmania. Here's how he tells .

Crossed wires

This story is being written on a 6- ear-old BBC micro-computer. It's ow an old-fashioned machine, with nly 32K of user memory. But with s operating system and the word rocessor routine both in ROM, the achine has proved more than ade- uate for the jobs I use it for.

Coupled to the machine is a dual ingle sided disc drive, a Star Gemini printer, an English Nightingale modem and a Thomas green screen monitor. All in all, it represents $2500 worth of computer equipment and I'd be totally lost without it.

Alongside me as I write is another, far less fortunate BBC computer, the subject of the photos on the following page. It suffered from the careless machinations of a would-be serviceman and is now a part of $2500 worth of junk.

The photos tell most of the story in graphic detail. What more need I say?

It seems that the owner of the machine wanted to operate it at a distance from the nearest power point so he asked his "friend" to make up an extension power lead for him. The so-called friend did so, but crossed over the active and earth leads, with very expensive results. The 240V AC was applied to the computer via the earth line and blew the lids off most of the ICs on the main board. At the time of writing, it seems that only the keyboard escaped total destruction.

But that's not all! The 240V found a path out of the main board to the monitor, disc drive and modem lines, and played merry hell with all of their semiconductors along the way. The resultant current finally went through the printer, leaving a charred and very expensive mess behind it.

If it had been my computer, I'd be weeping tears of blood. But then, I would have made up my own extension lead and I would have been more careful with the active, neutral and earth leads, wouldn't I?

(A later investigation showed that even the keyboard did not escape entirely. Three chips, three resistors and several diodes were totally cooked. The key switches did survive and they have been salvaged for possible use in my machine at a later date!)

Well, that's J.L.'s story and, as they say in the classics, that was a fair dinkum, no-mucking-about, kind of "Oops".

Belting a VCR

Finally, here is a short story which, as well as highlighting the tendency of some servicemen to assume the worst, may also provide a couple of helpful comments for other readers.

It was inspired by problems with a Hitachi video recorder, model VT-33E.

Is Your Product Or Service Getting The Exposure It Deserves?

25,000 consumers will read this page. They need to see your advertisement if you want them to buy your product.

Contact Paul (018) 28 5532 or Ian (03) 696 5411 to reserve this space.

TV TEST EQUIPMENT THAT WILL EARN YOU MORE MONEY

(AUSTRALIAN MADE)
12 Months Warranty

SHORTED TURNS TESTER
Built-in Meter to check EHT transformers including split diode type, yokes and drive transformers.
$78.00 + $3.00 p&p

HI-VOLTAGE PROBE
Built-in meter reads positive or negative 0-50kV. For checking EHT and focus as well as any other Hi-tension voltages.
$98.00 + $5.00 p&p

LOW VOLTAGE PROBE
Ideal for checking microwave ovens and TVs. The ranges are from 0 to 5kV Negative and from 0 to 10kV Positive. Double insulated for safety.
$84.00 + $5.00 p&p

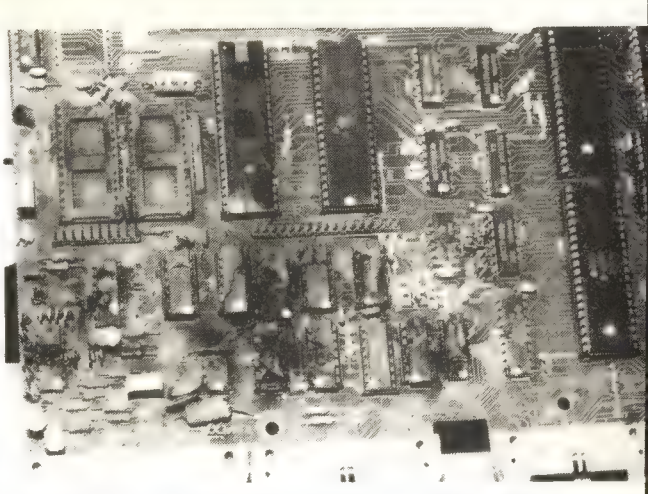
DEGAUSSING WAND
7,700 apere turns. Strong magnetic field, larger than usual coil with multicore centre. Double insulated for safety with momentary on/off switch. 240V A/C 2.2 amps.
This one is just about as important as having a soldering iron in your toolbox!
$75.00 + $10.00 p&p

REMOTE CONTROL TESTER
(INFARED OR ULTRASONIC)
Designed to test any Infared or Ultrasonic control units. With the extension lead you can also test infared units which cannot be placed in front of the testing unit. Requires a 9V battery. Output is via the LED diode and piezo speaker.
$85.00 + $4.00 p&p

TUNER REPAIRS from only $17.00 + p&p
We also repair most tuners on an exchange basis.
Cheque, Money Order, Bankcard or Mastercard

J.V. TUNERS
216 Canterbury Road, Revesby, NSW, 2212, Australia
Telephone (02) 774 1154

This is what 240V AC can do to a computer motherboard. These burnt & melted chips were fed with mains voltage after the active & earth leads were swapped on an extension cord.



It looks like a bombed-out factory in World War II. This another section of the main circuit board of the BBC microcomputer after someone connected 240V AC to the PCB earth track.

This model is about eight years old and appears to have been very reliable. I have encountered few faults until recently; just the odd minor one or a routine head clean, etc.

But lately I have encountered several with what appeared, initially, to be quite puzzling "funnies". In fact, all were due to the same basic cause, albeit with variations.

It's the drive belts that case all the problems. There are no less than six belts in this machine and failure of any one can produce a range of (sometimes) puzzling symptoms. Five belts are on the underside of the machine, while one is on the top side.

On the underside, two belts run from the capstan motor which carries two pulleys. One of these pulleys is about 12mm diameter and engages a wide belt which drives the capstan shaft via an 80mm pulley. The other pulley is about 20mm diameter and engages a longer belt which then drives a larger pulley (about 40mm diameter).

This latter is on an intermediate shaft which carries a second pully, about 18mm diameter, and from this another belt drives a second pulley, again about 40mm diameter, on the idler shaft. This carries the tyred idler wheel which drives the takeup or supply reel, according to the operating mode.

Also on the underside is the loading motor and this drives the two arms which extract the tape from the cassette and wrap it around the drum. The link between the motor and the loading mechanism is via two belts. The loading motor pulley is about 10mm diameter and drives an intermediate pulley of about 20mm diameter via the first belt. A second (12mm) pulley on the same shaft is then coupled via the second belt to a 20mm pulley on the loading mechanism shaft.

That accounts for five belts. The sixth one, above the chassis, couples the takeup reel to an impulse generator which feeds the microprocessor. Its function is to confirm that the takeup reel is functioning.

Faulty diagnosis

The recorder came to me with the story that it sometimes refused to run a tape. It had been taken to another service organisation whose diagnosis was that it was a microprocessor fault and that, as an old machine, it was not worth fixing.

I opened it, confirmed that no belts had been changed, then put it through the load function. It appeared to load normally; the tape actually starting to run. Then everything stopped. Acting on experience, I applied gentle pressure to the last pulley in the loading mechanism chain. It moved a fraction and - bingo! - the tape began to play.

It was a classic fault. Both of these belts are prone to go spongy and lose their elasticity. Then they will no longer drive the loading arms fully home; nearly, but not quite - and not hard enough to activate a protective sensor. So the machine shuts down. (I admit that this one tricked me for a while, the first time round).

Another rather alarming sympto of this condition is that, as the syste attempts to load, it will produce violent screeching sound; somethi which sounds exactly like a dry bea ing about to sieze. That noise is si ply due to one of the pulleys spi ning against the belt.

The cure was simple; a comple set of new belts and a new idler ty plus a routine clean and lubricat restored the machine to first cla condition. So much for the "it's n worth fixing" diagnosis.

A more obvious belt fault involv the top belt coupled to the take reel. This sometimes breaks an while the machine will load, it w not run. The microprocessor kno the takeup reel is not functionin and shuts the machine down. Fort nately, this is easy to pick.

I have also encountered a brok belt in the drive from the capst motor to the idler wheel - the larg one in this case. Again, while t machine will load, it will not ru because the microprocessor is bei told - genuinely - that the takeup re is not functioning.

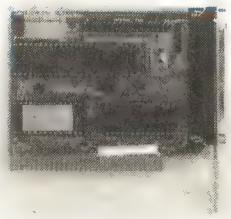
This is also easy to see, but a sli ping belt in this chain could cre more puzzling symptoms if it fail only momentarily, in the middle o run.

All of which adds up to a simp piece of advice. Any VCR of this ag and the VT-33E in particular - whi exhibits similar symptoms, may w have a belt problem. And don't mu about; change all the belts. If one dead the rest are dying.

OUR FIRST AFTER STOCKTAKE CLEARANCE SALE

You get the bargains at never to be repeated prices

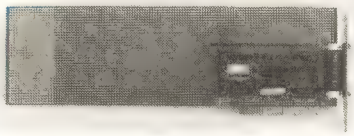
xternal Floppy drive controller card, ıcluding case and ables Code: DC122OE



is is an intelligent floppy disk con-ller card for external drives. It can e used with existing internal control-r cards and supports all standard ive formats. For use in IBM XT/ AT/ 6-AT or compatibles.

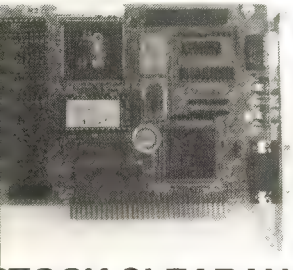
$199.00

Universal wire wrap card Code:IF054



Designed for engineers and other technical developers and is fitted with universal decoding component and a user programable I/O chip (PAL 16L8). This has board 4000 wire wrap holes which are plated through for easy prototyping and is a full length card, with a D25 connector femal connector. For use on IBM PC/XT/AT or compatibles.

Save $26.00 only $99.00



Enhanced EGA graphics adaptor

Normally priced at $125.00

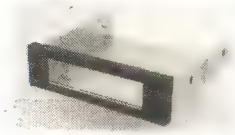
Code: VCEGA

Suitable for IBM PC/XT/AT with a full 256kB video memory. The card has light pen interface and external DIP switch for easy display mode selection. Only uses a short slot. Also features auto-switch utility and will support 132 column text mode. . Provides 640 x 480 extended EGA resolution.

Super Special only $50.00

STOCK CLEARANCE BUT ONLY LIMITED QUANTITIES ON THE FOLLOWING ITEMS

daptor tray for 3.5" FDD



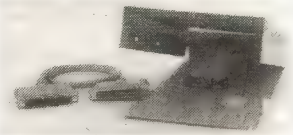
Vill fit in a 5.25" slot. These have black front panel

Quantity : 13 only

only $5.00ea ***Normal price $25.00***

Single height 5.25" external drive case

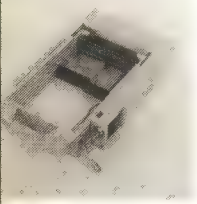
CAEX5 - These come complete with cables and a high quality metal case.



Quantity: 4 only

only $20.00

Normal Price $99.00



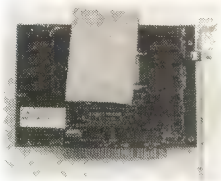
Removable hard disk case

CAPD - Now you can remove your hard disk without having to pull your machine apart. Has key lock.

Quantity: 4 only

only $50.00

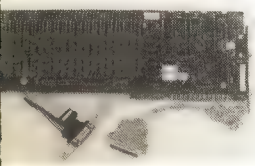
Normal Price $199.00



Fastcard for 8088 - IF286S

Upgrades your 8088 machine to perform at the speed of an AT. Now there is no need to throw out that old maachine of yours. **Quantity: 12 only**

only $99.00 *Normal Price $495.00*



Multifunction 3.5MB / RS232 x 4 card

RC2350 - Expand your machine up to 3.5MB as well this card has 4 -RS232 serial interface for control of modems or serial printers. Also has a parallel printer port and game port. RAM not included.

Quantity: 7 only

Now only $75.00 *Normal Price $299.00*

3.5" external drive case

Quantity: 9 only

Save $74.00

only $15.00

5.25" external drive case - CAEX52

Quantity: 7 only Save $100.00

now only $25.00

SEE OUR OTHER ADVERTISMENT IN THIS ISSUE FOR YOUR FREE 1991 CATALOGUE OFFER

MasterCard bankcard VISA

Due to Technical advances, products we supply may in some cases vary from those pictured. In all cases the products supplied are guaranteed to perform to an equal or higher standard than those pictured

ELECTRONIC SOLUTIONS

Electronic Solutions

5 Waltham St Artarmon 2064 **PO Box 426 Gladesville 2111**

Telephone: (02) 906 6666 Fax: (02) 906 5222

REMOTE CONTROL

BY BOB YOUNG

Galloping ghost - the missing link in the evolution of proportional control

These days, modellers take proportional control systems for granted, without realising just how much better they are than the systems they made obsolete. This month, we take a look at a system which was popular before digital electronics took over.

Over the past few months, we have discussed much in relation to the modern radio control system but we have yet to answer some vital questions: "what exactly is digital proportional control; why is it so good; and how did it evolve?"

All of these questions will be answered in the following series of articles.

However, before progressing further, I would suggest that the reader refresh his memory with the first article in this series, published in the October 1989 issue, for much of the history of the developments leading up to this system was covered there.

For those who missed that article, it is sufficient to state that prior to proportional control, the typical multi-channel R/C system was usually some sort of audio tone system using either filters or tuned reeds for decoding. Tuned reeds were by far the most popular and successful system, certainly in this country and in America.

Now the point here is that these systems only gave two to three simultaneous controls (usually two) but, most important of all, they only gave *neutral, full clockwise and full anti-clockwise* control positions. No intermediate positions were available.

This was not really satisfactory for any form of modelling but despite these shortcomings, the best flyers could give demonstrations which would be hard to distinguish from those given by flyers today using modern proportional control equipment.

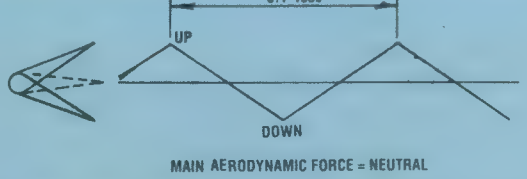


Fig.1: the inertia of the model plus the elasticity of the air will average out a rapidly oscillating control to give smooth flight. If the control oscillates symmetrically about the neutral position as shown here, the result will be neutral control.

We learned to adapt and we learne all the tricks. A separate servo wa used for elevator trim, one whic could be nudged into the correct po ition and left there until retrimmin was required. A similar type of serv was used for throttle as well.

Pulsed controls

Controls could be pulsed to ave age out the aerodynamic effects an short pulses only gave small contr throws. Long pulses gave about ha throw and the lever held full on gav full throw of course. The pulses nev showed up in the manoeuvres and a looked perfectly smooth - in the hanc of an expert that is.

The average flyer, which include myself, never really knew what make of all of these shortcomings an thus we never really learned to fe comfortable with this system. Believ me, I crashed many a good mod trying to master this system.

Something had to be done, and w all knew what it was. But the burnin question was how?

This problem, like all problem when solved, turned out to be easy so easy as a matter of fact, that I wa stunned at the time at just how simp and effective the system really wa But let me tell you that the proble occupied many of the finest minds i the electronics world and baffled mo of them until the early 1960s whe two Americans, Don Mathers an Doug Spreng, developed the propo tional system as we now know it.

So complete was their approac that to this day little has been change except the technology applied to sol ing the practical problems. Howeve we are now a little ahead of our stor

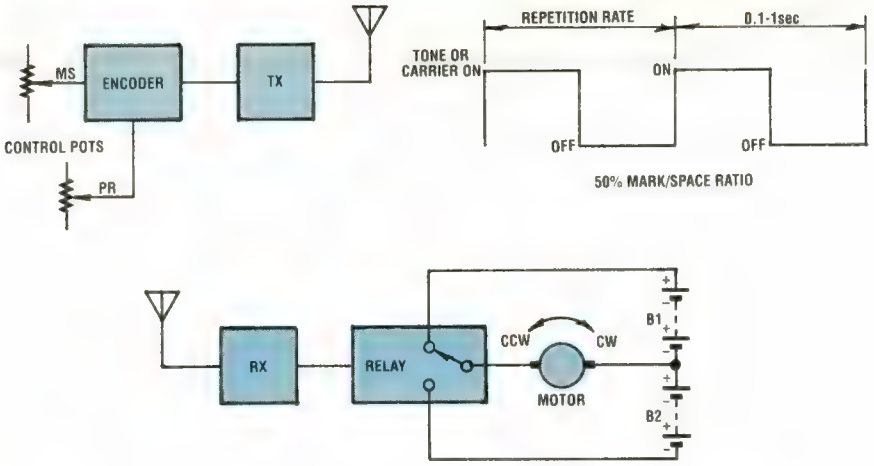


Fig.2: the "Galloping Ghost" system used mark-space/pulse rate encoding & decoding. In this scheme, the decoded pulses controlled a relay & this in turn was used to rapidly switch a small electric motor first in one direction & then the other. The model thus responded to the mean aerodynamic position of the control surface.

having missed that important step mentioned earlier.

The Galloping Ghost

What on earth was the Galloping Ghost? I can hear the readers now: 'this lad has finally flipped for real and is now seeing apparitions". Sorry to disappoint you, but "Galloping Ghost" is the name given to that missing step in the proportional control story.

Earlier, I mentioned that the inertia of the model and the elasticity of air will average out rapidly oscillating controls and give a smooth result around the averaged control positions, as shown in Fig.1.

Now this phenomenon has two very important uses:

(1). If interference or weak signal areas are encountered, then random noise intruding into the servo amplifier will strike some sort of average which may be anywhere from full down to full up. This average is changing rapidly but, combined with the occasional snatch of uncorrupted control data, will often keep a model flying until full control is restored. This is the factor that made PPM such an effective system and which renders the concept of "fail-safe" (neutralised flying controls) invalid.

(2). It's also useful in the Galloping Ghost type systems of constantly flapping servos, in which the rapid flutter is deliberately introduced and averaged out to a mean aerodynamic value by virtue of a controlled encoder. This is our missing link in the chain of development leading to true digital proportional control.

The basis of the Galloping Ghost system was the concept of mark-space, pulse-rate decoding. In this system, a small electric motor was connected directly to the terminals of a relay which was switched by an encoder. This encoder was controlled through gimballed joysticks driving potentiometers, suitably arranged to vary the mark-space, pulse-rate ratios of the relay switching.

Oscillating control surfaces

The name "Galloping Ghost" came from the frantic appearance of the constantly thrashing control surfaces. To hear a model gliding overhead controlled by this system was a real experience - the noise was unbelievable. Of course, the motor armatures and brushes didn't take too well to this sort of treatment.

Nevertheless, the system was remarkably reliable considering the strain on the motors and relays. The block diagrams in Fig.2 show the theory behind this truly incredible and very primitive system. Fig.3 gives the timing diagrams for various combinations of mark-space ratio and pulse-rate.

For a modern modeller, versed in the art of digital electronics, the following system will seem almost incomprehensible, yet it formed a major link in the chain of development and some really satisfying flying was done using this system. It also serves to indicate just how difficult the problem of achieving proportional control really was and just how powerful the techniques of digital electronics are today

The electronics revolution has largely been possible due to digital concepts and it is difficult for modern readers to realise that in 1960 very few of us had even heard of the term, let alone had any knowledge of the techniques involved.

Fig.4 shows the way the two separate control outputs are taken from the servo drive disc, one for the elevator and one for the rudder. The series of diagrams in Fig.5 shows the way in which the mean aerodynamic force is generated for the two controls; in other words, the decoded output. The system worked as follows:

The transmitter was a conventional single-channel type using either tone modulation or straight carrier switching. A mark-space, pulse-rate encoder controlled the transmitter and delivered to the receiver a coded signal carrying two streams of data. One stream consisted of a signal with a mark-space ratio varying from 20-80% to 80-20%

Is Your Product Or Service Getting The Exposure It Deserves?

25,000 consumers will read this page. They need to see your advertisement if you want them to buy your product.

Contact Paul (018) 28 5532 or Ian (03) 696 5411 to reserve this space.

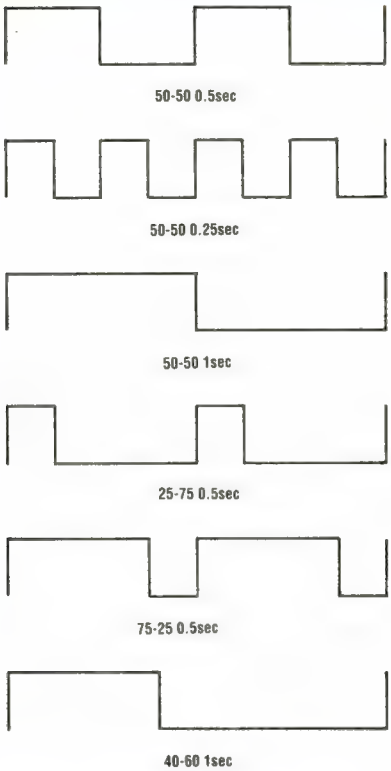


Fig.3: these timing diagrams show various combinations of mark-space ratio and pulse-rate for a proportional control system.

The second stream was carried in the coded signal generated by the variation of speed at which this mark-space signal was repeated, commonly termed the pulse rate. This rate was usually varied from approximately 0.1s to 0.8s. The exact rate depended upon the transit time of the servo motor.

Both these signals were of course superimposed upon one another and needed to be separated at the receiver end. Now the logical and modern thing to do would be to use solid state, mark-space, pulse-rate detectors and this was eventually done in some systems, but once this constantly variable DC voltage is generated, what do you do with it? Remember, this is in the days long before ICs and those nice little op amps.

This was in the electronic dark ages and electronic solutions were prohibitively expensive. I can remember buying my first transistor around this time; it cost me 25 shillings and I bled for a week. However, we are ahead of our story again.

Motor decoding

Modellers, being by nature a tight fisted lot, came up with a primitive but effective system using a single electric motor for decoding.

Fig.4 shows the mechanical arrangement of the basic mark-space, pulse rate decoder. The mark-space decoder is simply a slotted yoke mounted and pivoted at a suitable point to allow the control pin to accomplish almost one complete revolution (80% of a revolution to be exact). This yoke is usually connected to the rudder of the model, neutral being at the 12 o'clock position.

If the motor rotates clockwise, the rudder will turn right, for example, and if the motor rotates anticlockwise, it turns left. In practice, the relay is switching constantly between open and closed at a mark-space ratio determined by the transmitter encoder.

Thus, we now have a yoke which will deliver to the control surface a deflection which is rapidly and equally varying around neutral if the mark-space ratio is exactly 50%. If the mark-space ratio is varied, then the average position will shift from neutral in an amount directly proportional to the mark-space variation (Fig.5d & 5e).

Fig.4 also shows the arrangement for the pulse rate detector, which is simply another yoke set at right angles to the first and again pivoted suitably to allow the control pin to rotate freely over 80% of a revolution.

If the pulse rate is taken to its highest, the motor oscillates quickly about the 12 o'clock position and the average deflection is considered to be "up" elevator. (The rate control was usually connected to the elevator in the model). As the rate was slowed, the motor had more time to rotate and the average position moved towards the "down" position.

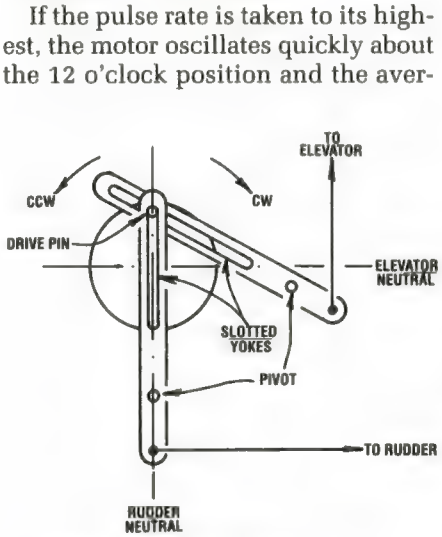


Fig.4: this diagram shows the arrangement of a mechanical mark-space/pulse rate decoder. The mark-space decoder consisted of a slotted yoke connected to the rudder, while the pulse-rate detector used a second yoke (connected at right angles to the first) to control the elevator.

At the slowest rate, the elevator was in the full "down" position. Note here that, in effect, full down is really neutral elevator. Fig.5c shows the timing of the arcs involved. However, the dwell time at servo reversal added to the down elevator effect and the trimming of the model biased the system to account for the rest.

In this way, we achieved two proportional controls from a single channel receiver - quite a step forward but well short of the requirements for a model aircraft, in which four simultaneous controls are the minimum required for full control.

Note also that the decoding was far from perfect, with a great deal of mixing between controls occuring (Fig.5 illustrates this quite clearly). Theoretically, the transmitter joystick should have been positioned in the centre of a square hole, but in order to overcome some of the problems of the control mixing, which occured mainly at control extremes, there were some strange configurations at the borders of this no longer square hole.

In fact, you had to learn to fly not to the spring centre of the sticks but to the feel of the model. If it was going where you wanted it, then it really did not matter much where the stick was. You never had time look at that anyway. Believe me, it was all you could manage to keep the model airborne.

It was ingenious, simple, cheap and diabolically primitive. However it worked, and worked well and gave many of us a taste for a much more professional system, if only we could work out how to do it, that is.

New developments

There were several important developments that followed on from this basic system.

One was the system marketed by Dr Walter Good in which two audio tones were transmitted simultaneously, each modulated for mark-space pulse rate. This gave four simultaneous proportional (galloping) channels. Motor control was achieved through a trimable (positionable) servo driver

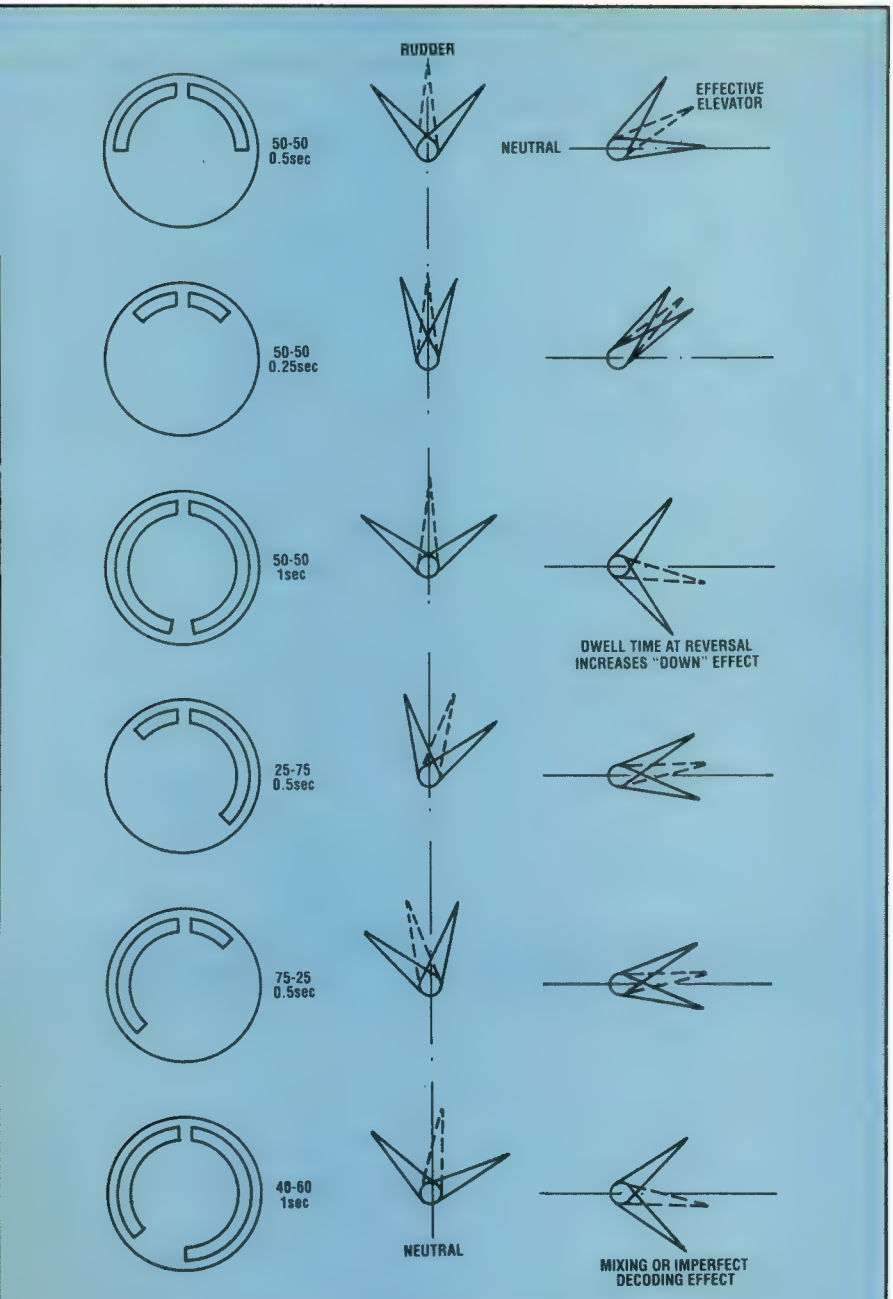


Fig.5: this series of diagrams shows the way in which the mean aerodynamic force is generated for the two controls; in other words, the decoded output. Note how the rudder moves away from the neutral position for mark-space ratios other than 50:50, while the elevator position varies according to the pulse rate.

om a pulse omission detector on ach of the two tone channels - one r high throttle and one for low.

This was a very sophisticated and omplex system for its time and held s all in awe whenever the very occa- ional example showed up on one of ur fields. Here was a taste of what as soon to come. The feel of the ansmitter was marvellous and those vin proportional sticks felt just right, compared with the five cumbersome lever switches on our reed transmitters. Never mind that the performance of the rest of the set was as primitive as it is possible to imagine.

A model fitted with three flapping controls was a sight to behold but at the time, we thought it was great.

They were exciting days and it is impossible for modern modellers to comprehend the degree of yearning that the dream of true, simultaneous control generated in us.

One must remember that at that time, a transistorised anything was rare on our fields, for many of us were still flying single channel valve sets. As a matter of fact, I did not stop producing valve super-regenerative receivers until around 1969, long after I began producing a solid state superhet 6-channel digital system. Even then, the only thing that stopped me was the difficulty in obtaining valves and 22.5V batteries.

The demand for a valve system was always there. In this respect, a trip to the flying field was always very interesting, for one would see operating, side by side, valve super-regen single channel systems, superhet reed, 8-channel audio tone, Galloping Ghost, Walter Good dual Galloping Ghost, and a host of home-made systems using many and varied approaches.

The final step in the mark-space systems came with the development of solid state mark-space, pulse rate decoders. These delivered a DC output proportional to the input. From here the difficult part began. Just what could you do with this sort of output? These days, a DC-coupled, closed loop feedback servo would be possible but this was well before op amps.

The answer in those days was to feed this power into a magnetic actuator. This device consisted of a circular magnet inside a coil wound at right angles to the magnetic field. This was lightly spring-loaded for return to neutral. Thus, with the polarity aligned in one direction, the magnet would begin to deflect clockwise and with the current flow reversed, in the counter clockwise direction.

The greater the power fed into the coil, the more deflection obtained. They were not very powerful, giving about 3-5 ounces on a spring balance, but this was enough for a lightly-loaded, slow-flying aircraft.

They were quite accurate and gave true and smooth proportional control, free of the gallop and decoding mixing associated with the "galloping ghost" systems.

They were, however, not the answer we were looking for. That had to wait until two very gifted Americans made their contribution to the field of radio control and that story will be told in next month's issue. See you then. **SC**

AMATEUR RADIO

BY GARRY CRATT, VK2YBX

Oscillators - which type is best for you?

Last month, we discussed the operation of quartz crystals. Following on from that article, we discuss the different types of oscillators that can be used in amateur equipment, both crystal and free running types, and the advantages of using particular types.

Without going into the detailed circuit theory behind oscillator design, there are two basic conditions that must be fulfilled in any design before oscillation can occur:

(1). the amplifier around which the oscillator is based must have a gain of more than one; and

(2). positive feedback must be applied between output and input.

Fig.1 shows the block diagram of a basic oscillator. As can be seen, there is a feedback path from the active device output to its input, leading to the conclusion that the oscillator is essentially a feedback amplifier that supplies its own input.

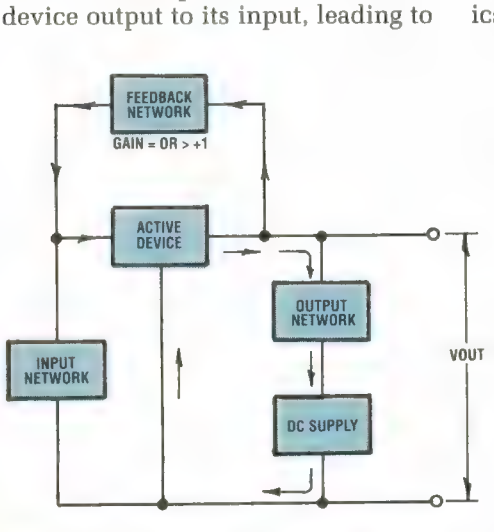


Fig.1: block diagram of a basic oscillator. Note the feedback network from active device output to input.

There are many types of oscillator designs, each with a particular advantage depending upon the application. In some applications (eg, the local oscillator in a superheterodyne receiver), it is necessary to use an oscillator design having good spectral purity and stable frequency characteristics. Other applications require a design that will be rich in harmonics; eg, a circuit requiring the use of an overtone crystal,

Frequency stability is also often an important factor, as several stages of frequency multiplication may be used after the oscillator to reach the output frequency. There is also the added complication of temperature stability. Because temperature changes can affect the operating frequency, care must also be taken to maintain a stable temperature.

Hartley oscillators

Fig.2 shows the circuit of a Hartley oscillator. The frequency of oscillation is determined by L1 and C1. The amount of feedback is determined by the ratio of the reactance of L1a and C1 (the voltage divider network within the tuned circuit), and the feedback energy returned to the tuned circuit by the current passing through L1b and C3

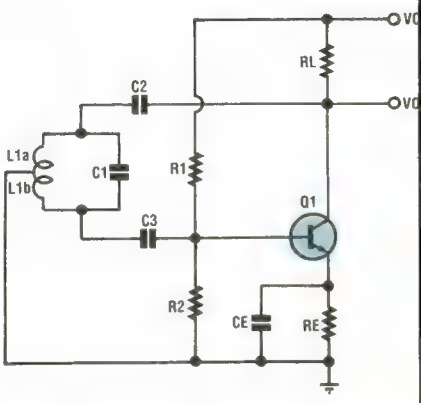


Fig.2: the Hartley oscillator. This type of oscillator exhibits a constant output voltage over its tuning range.

This type of oscillator is most commonly used in VFO circuits due to its constant output level over the tuning range. However, this oscillator type has one major disadvantage and that is the high level of harmonics. As can be seen from Fig 2, the reactance of L1 increases with the output frequency. This means that harmonics of the fundamental frequency are developed in the tuned circuit and returned to the input, then being further amplified before appearing, along with the fundamental, in the output.

Thus, in order to use a Hartley oscillator sucessfully, a bandpass filter is required after the tuned circuit. Alternatively, a double tuned collector tank could be used.

Colpitts oscillator

The most common type of oscill

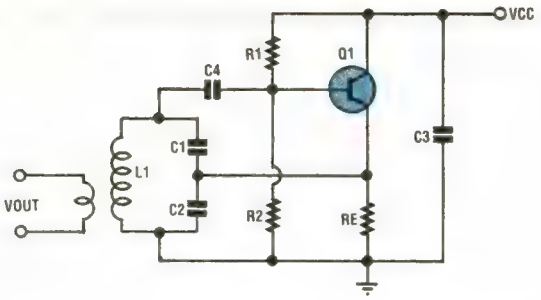


Fig.3: in the Colpitts oscillator, the emitter of the transistor is connected to the junction of two capacitors (C1 & C2). The main advantage of this configuration is low harmonic content in the output.

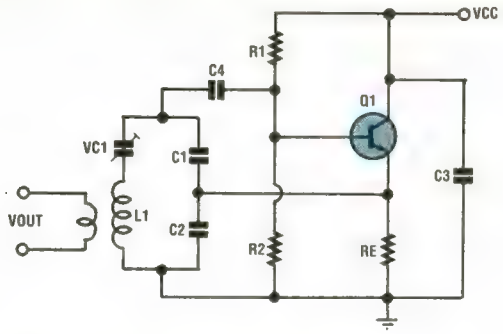


Fig.4: the Clapp oscillator is similar to the Colpitts configuration but employs a variable capacitor (VC1) in series with the tank coil (L1). This provides improved stability and allows tuning.

or using an inductive divider network is the Colpitts oscillator - see ig.3. This circuit differs from the artley oscillator in that the emitter f the transistor is connected to the nction of two capacitors (C1 & C2), stead of tapping the inductor. The oltage divider is formed by L1 & C1. Typically, C1 is three times the alue of C2 to ensure reliable oscillaon. Changing the value of L1 or C2 ill change the frequency, while anging the value of C1 will vary the utput level.

Colpitts oscillators are used because f their high spectral purity. Because e feedback voltage is developed cross a capacitor, the reactance of hich decreases at harmonic frequenies, the harmonic content is low. owever, the main disadvantage of is type of oscillator is the difficulty varying the output frequency without varying the output level. In fact, it necessary to vary both capacitors, hilst maintaining the ratio between em.

The Clapp oscillator is a variation f the Colpitts design, where a series ariable capacitor has been added to e tank coil (L1). This provides improved stability and allows tuning of e oscillator. If the value of the trimer is low compared to the value of 1 & C2, then the feedback ratio will e largely unaffected when the oscillor is tuned. Fig.4 shows the deils.

rystal oscillators

Although the previous designs can be used in many applications, a quartz crystal oscillator is inevitably used where good stability and a high Q are required. Figs.5 & 6 show how a crystal can be used as the active resonant element in both Hartley and Colpitts oscillators. If an additional degree of stability is required, the Pierce oscillator design shown in Fig.7 can be used.

The conditions to sustain oscillation are present only at the frequency which makes the crystal behave as an inductive reactance. Hence the crystal replaces the inductor in the circuit. Variable capacitor VC1 allows a small adjustment to be made to the output frequency.

The circuit operation is identical to that of the Colpitts oscillator. The feedback voltage is developed by the network comprising the inductance of the crystal and C1, while the energy to maintain oscillation is returned via C2.

In addition to fixed frequency oscillators, circuits are available to al-

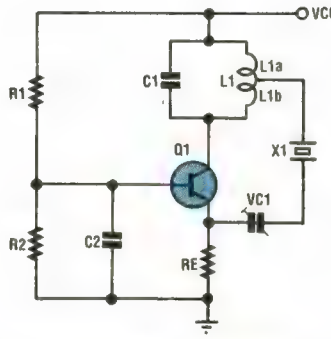


Fig.5: quartz crystal oscillators are used when good stability & high Q are required. This Hartley oscillator uses crystal X1 as the active resonant element.

Quartz Crystal Oscillators

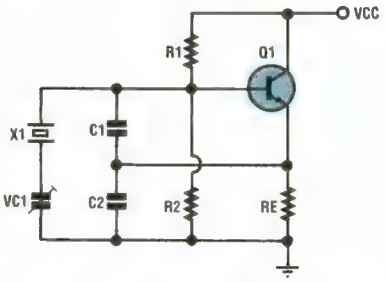


Fig.6: a crystal controlled Colpitts oscillator. VC1 allows some adjustment of the output frequency.

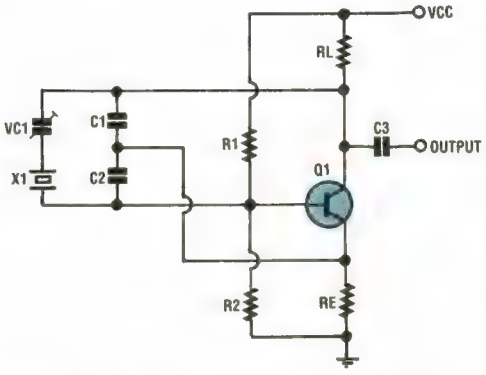


Fig.7: a crystal-controlled Pierce oscillator. It operates in exactly the same way as the Colpitts oscillator but offers improved stability.

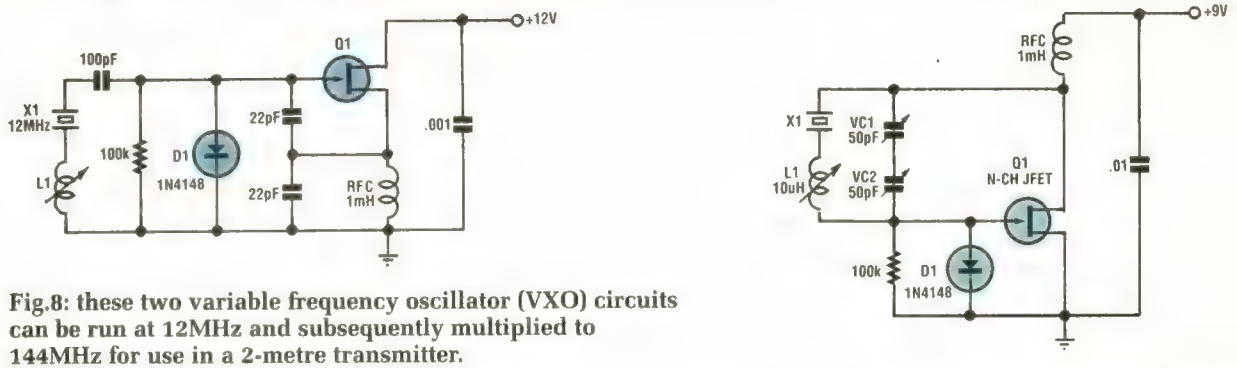


Fig.8: these two variable frequency oscillator (VXO) circuits can be run at 12MHz and subsequently multiplied to 144MHz for use in a 2-metre transmitter.

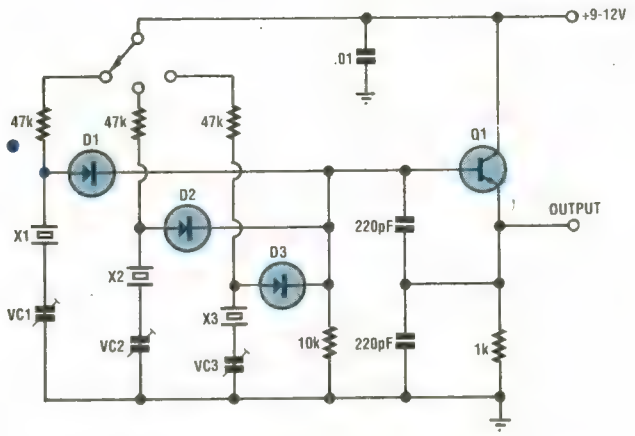


Fig.9 this modified Colpitts oscillator uses diode switching to select between three different crystals (X1, X2 & X3).

Fig.10: experimental oscillator circuit based on the Motorola MWA-120 MIC (microwave integrated circuit).

low crystals to be "pulled" in frequency, allowing as much as 8kHz to 10kHz of frequency change to be achieved. These circuits are called variable frequency crystal oscillators or VXOs.

In a 2-metre transmitter, if a crystal oscillator followed by several stages of frequency multiplication was used it can be seen that at least 100kHz o frequency adjustment would be avail able at the output frequency.

Two circuits that can be used a 12MHz (and subsequently multiplie to 144MHz) are shown in Fig.8.

A buffer stage should always b used after a VXO to eliminate fre quency pulling. VXOs are a compro mise between cost (simplicity) an full band coverage. However, if onl a small segment of an amateur ban is of interest, such circuits can b used.

In addition, a scheme to switc crystals covering segments of the ban could be implemented as shown i Fig.9. Here, a Colpitts oscillator ha been modified to allow diode switch ing of a bank of crystals.

A superior approach is to use VFO circuit, some of which are cap able of operation over several mega hertz at VHF or UHF. Without goin into design detail, VFOs for HF ten to use large plate variable capacitor and rely on mechanical stability an vernier gearing to give good stabilit and adequate frequency coverag These units often only need to cove 500kHz, as the output can be mixe up to any HF band.

VFOs designed specifically fo VHF/UHF work tend to be PC boar mounted and varicap tuned, relyin on multiturn potentiometers or opto coupled controls for stability and fre quency coverage.

Also of interest to amateurs work ing at VHF is the advent of MIC (microwave integrated circuits) which these days form part of man RF systems. The most common MI is the cascade amplifier, often de signed with 50-ohm input and outpu impedances. Provided a resonant ne

ork with a phase shift of 180° at the sired operating frequency and some m of current limiting external to e MIC are used, output levels of ound 6dBm are achievable. Fig.10 ows the experimental circuit used, sed on a Motorola MWA-120.

Finally, Fig.11 shows a series of cuits using an MMIC, illustrating e simplicity of oscillator design ing these devices.

rther reading

One of the most comprehensive blications on RF oscillator design s recently been released by Cardiff blishing Company, 6300 S. racuse Way, Suite 650 Englewood, lorado 80111. Called "Oscillator sign Handbook", it is available from publishers for around $20.

eferences

(1). Oscillator Design Handbook; . ARRL Handbook; (3). VHF/UHF nual - G.R. Jessop, G6JP; (4). Essentials of Communication Electronics - Slurzberg/Osterheld.

Footnote: The MWA-110/120 & MWA-310/320/330 MICs should be available from Motorola stockists (VSI Electronics, etc). The uPC1651 MMIC is available from Dick Smith Electronics. **SC**

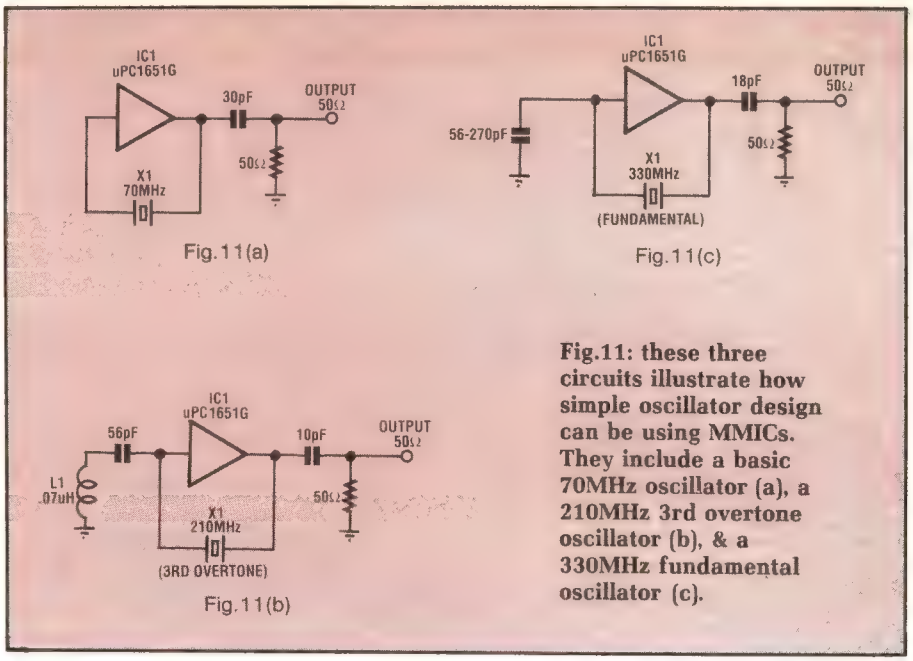


Fig.11: these three circuits illustrate how simple oscillator design can be using MMICs. They include a basic 70MHz oscillator (a), a 210MHz 3rd overtone oscillator (b), & a 330MHz fundamental oscillator (c).

C INSTRUMENTATION FOR THE 90s

stralia's widest range (over 10,000 items) of PC/XT/AT/'386 based engineering/industrial and scientific hardware and software.

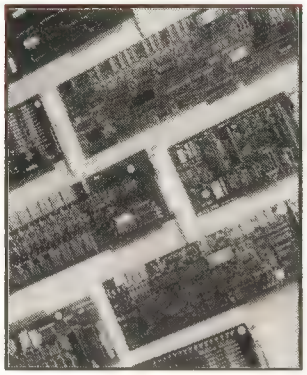
Applications include • Aerospace • Test & Measurement • R & D • Data Acquisition • Image Processing • Communications • Control.

Call us today for your free catalogue.

SOME EXAMPLES OF OUR HARDWARE

Revolutionary new low cost—
Hz analogue to digital
D channels
channels
gital I/O
r/counter
oftware support (incl. source code)

192 lines of digital I/O
Programmable digital I/O lines
ustry Standard 8255 PPIs
try Standard pin outs
Software in C and Quick Basic



GP200 IEEE-488/GPIB Interface
- TMS 9914A GPIB Controller
- Fully compatible with IEEE-488 1978 spec.
- 14 Devices simultaneously supported
- On board clock oscillator
- DMA mode available
- Short slot/low power

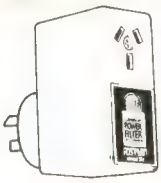
PC-82 Universal Device Programmer
- Programs PALs, EPROMs to 4M PROMs, GALs
- Constantly expanding software device library
- Tests TTL 74/75, CMOS 40/45, SRAMs, PROMs
- Programs single chips without adapters

's•chirp xforms•high speed low cost a/d boards•curve fitting software • scientific plotting software • pal/eprom, programmer software • uv erasers • rack mounted monitors • rack mounted PC's • ruggedized rack-mountprinters • pc assis • extender cables • ruggedized hard disk drives • solid state disk drives • labtech notebook • asyst 3.1 • easyest software • labwindows • labtech control software • control eg software • 400khz a/d boards • pc lab boards • 1 ed das systems • on board microprocessor based systems • low cost data acquisition boards • 32 bit a/d boards • workbench pc software • high speed analogue output boards • high speed digital i/o boards • relay control boards tioning boards • rs422/485 interface boards • 800 mhz equivalent time sampling digital scopes • ieee488 boards • logic analyser boards • waveform/frequency generation systems • quadrature encoder boards • stepping motor controllers otor systems • servo motor amplifiers • pid loop controllers • mac hardware/software systems • engineering and scientific software systems • 8051 hardware/software systems • strain gauge amplifier boards • 2000 digital i/o boards rds • screw terminal boards • image processing systems • low cost colour frame grabber boards • high speed frame grabber boards • black&white frame grabber boards • real time spreadsheets • data communication test sets • simulators, blers & debuggers • lcd/led intelligent programmable displays with pc interfacing voice • output boards • pc performance analyser • pc based protocol analysers • high speed serial data comms board • digital filter board • thermocouple a low power consumption boards.

BOSTON TECHNOLOGY PTY LTD

EAST COAST
PO Box 415
Milsons Point NSW 2061
Ph: (02) 955 4765
Fax: (02) 922 1118

WEST COAST
PO Box 1093
West Perth WA 6005
Ph: (09) 321 2899
Fax: (09) 321 2891



CPF CONTINUOUS POWER FILTER SPIKE ARRESTOR

The Fortron CPF Filtered Electronic Spike Protector provides a protective electronic barrier for microcomputers printers telephone systems and modems electronic typewriters audio and stereo systems and other sensitive electronic equipment

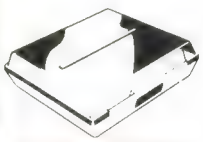
The CPF provides protection from dangerous electrical spikes that can cause anything from obvious damage (like immediate equipment failure) to less obvious harm that can drastically shorten a system's life

CPF s superior circuitry design and semi conductor technology responds instantly to any potentially damaging over-voltage ensuring safe trouble free operation

Additionally, CPF s filtering capability helps eliminate troublesome and annoying interference, general hash created by small motors, fluorescent lamps, and the like that threaten the performance and shorten equipment life of unprotected electronic components

SPECIFICATIONS:
Electrical rating: 220-260 volts (AC) 50Hz 10 Amp
Spike/RFI Protection: 4 500 amps for 20m second pulses
Maximum clamping voltage. 275V differential mode

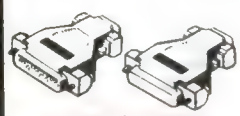
Cat.X10088 ..... **$69.95**



ENCLOSED PRINTER STAND

- Keeps your paper and print outs neat and orderly
- Transparent cover makes it easy to check on paper supply
- Paper can be fed from the centre or the rear according to the design of the printer
- Removable drawer which allows paper to be changed without moving the printer
- Retractable rear basket makes print-out collection fast and convenient
- Suitable for most printers

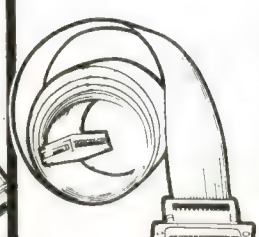
$69.95



9 PIN TO 25 PIN CONNECTOR ADAPTORS

NEW! The ideal solution! Features gold plated pins

X15668 DB9 Plug to DB25 Socket
X15669 DB9 Socket to DB25 Plug
each $8.95



5¼" FLOPPY DISK DRIVE EXTENSION CABLE

- IBM* compatible
- DB37 Male to 34 way edge connector
- Length 0.5 metres

P19045 ..... **$99.95**

3½" FLOPPY DISK DRIVE EXTENSION CABLE

- IBM* compatible
- DB37 Male to 34 IDC connector
- Length 0.5 metres

P19046 ..... **$99.95**

RS232 BREAK OUT BOX

A simple way of monitoring RS232 interface lead activity. Interface powered, pocket size for circuit testing, monitoring and patching. 10 signal powered LED's and 2 spares. 24 switches enables you to break out circuits or reconfigure and patch any or all the 24 active positions

SPECIFICATIONS:
Connectors: DB25 plug on 80mm ribbon cable and DB25 socket
Indicators: Tricolour LED's for TD RD, RTS, CTS, DSR, CD TC RC, DTR, (E)TC
Jumper Wires: 20 tinned end pieces
Power: Interface power
Enclosure: Black, high impact plastic
Dimensions: 85 x 95 x 30mm

X15700 ..... **$99.95**

COMPUTER PAPER

Quality paper at a low price! 2,000 sheets of 70 gsm bond paper

Cat C21003 11 x 9½" **$44.95**
Cat C21005 15 x 11" **$67.95**

KEYBOARD EXTENSION LEAD

5 Pin Din plug and socket

P19038..... **$9.95**

DELUXE PRINTER STAND

- Restores order to your work area without occupying extra space
- Feeds and refolds paper under the printer automatically
- Adjustable paper deflectors ensure smooth flow of paper
- Made of moulded plastic
- Suitable for most printers

C21058 (80 column) **$69.95**

MAGIC STAGE

A working bench for your Mouse.
- High quality ABS plastic and anti-static rubberised top
- Stationary holder
- Includes pull-out shelf for Mouse
- Dimensions: 280 x 260 x 25mm
- Fits over keyboard

C21080..... **$15.95**

SURGE BUSTER

6 PROTECTED POWER OUTLETS
Ideal for protecting personal computers, video equipment, colour TVs, amplifiers, tuners, graphic equalisers, CD players etc

SPECIFICATIONS:
- Electrical rating: 240V AC, 50Hz, 10A
- 3 x Metal Oxide Varistors (MOV)
- Maximum clamping Voltage: each MOV: 710 volts at 50 amps
- Response time: Less than 25 Nanoseconds.

X10086.....**$69.95**

THE BUTTON SPIKE PROTECTOR

Surges and spikes are caused not only by lightning strikes and load switching but also by other equipment being switched on and off, such as fluorescent lights, electric motors, fridge freezers, air conditioners, etc

For effective protection such spikes must be stopped before they reach your equipment. Simply plug The Button into an outlet and it will protect all equipment plugged into adjacent outlets on the same branch circuit. The Button employs unique metal oxide varister technology and will dissipate 150 joules of electrical energy (nearly twice that of comparable surge arresters)

SPECIFICATIONS:
Voltage 240V Nominal
Total Energy Rating 150 joules
Response Time 10ns
Protection Level 350V peak

..... **$36.95**

HEAD CLEANER DISKS

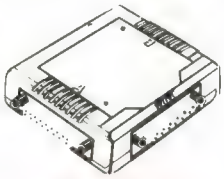
It only takes a minute amount of dust, dirt or magnetic oxide particles on your drive heads to cause problems: errors, downtime or an expensive service call. Regular use of a head cleaner will keep your drive free of trouble causing dirt and help keep your system up and running. These disk cleaners are simple to use, and include cleaning solution and instructions.

- 3 1/2"
C12560.....$6.95
- 5 1/4"
C12555.....$6.95

DISK NOTCHER

Converts 5 1/4" single sided floppy disks to double sided, by placing an appropriate notch in the floppy disk jacket.

C21070.....$5.00



POCKET AUTO AB SWITCHES

- Pocket size, auto-scanning
- Allows 2 PCs to share one Printer

Serial model:
MS-201 - Host-powered
X19150.....$79.95
Parellel model: MP-201
Protocol transparent
X19155.....$89.95

RIPPER STRIPPER

Remove ugly paper feed edges quickly and cleanly with this simple little gadget

C21085.....$14.95

2 & 4 WAY RS232 DATA TRANSFER SWITCHES

If you have two or four compatible devices that need to share a third or fifth, then these inexpensive data transfer switches will save you the time and hassle of constantly changing cables and leads around
- No power required
- Speed and code transparent
- Two/Four position rotary switch on front panel
- Three/Five interface connections on rear panel
- Switch comes standard with female connector

2 WAY Cat X19120 **only $39**
4 WAY Cat X19125 **only $49**

2 & 4 WAY CENTRONICS DATA TRANSFER SWITCHES

Save time and hassles of constantly changing cables and leads around with these inexpensive data transfer switches. These data switches support the 36 pin centronic interface used by Centronics, Printronics Data Products, Epson, Micronics Star, and many other printer manufacturers
- No power required
- Speed and code transparent
- Two/Four position rotary switch on front panel
- Three/Five interface connections on rear panel
- Switch comes standard with female connector
- Bale locks are standard

2 WAY (X19130) **only $49**
4 WAY (X19135) **only $59**

UV EPROM ERASER

Erase your EPROMs quickly and safely. This unit is the cost effective solution to your problems. It will erase up to 9 x 24 pin devices in complete safety, in about 40 minutes (less time for less chips)
- Chip drawer has conductive foam pad
- Mains powered
- High UV intensity at chip surface ensures EPROMs are thoroughly erased

Without timer
X14950..... **$129**
With built-in timer
X14955..... **$159**

DUST COVERS

DUST COVER

Keep your computer and accessories free of dust and grime while not in use

XT* Cover Set
C21066.....$14.95
AT* Cover Set
C21068.....$16.95

LEADS

PRINTER LEAD

- Suits IBM* PC/XT, compatibles
- 25 pin "D" plug (computer end) to Centronics 36 pin plug

•1.8 metres
P19029.....$14.95
• 3 metres
P19030.....$19.95
• 10 metres
P19034.....$39.95

IBM* CARDS

XT HD CONTROLLER $129
AT HD CONTROLLER $199
RS232/ SERIAL/ CLOCK..... $59
MONO/ COLOUR CARD $96
MULTI I/O..... $99
512K RAM..... $59
DIAGNOSTIC..... $849
TTL/ PRINTER..... $89
RAM 2M AT EXT/EXP ..$225
8M AT EXT/EXP $325
FAX CARD $595

4 PORT SERIAL..... $89
VGA 256K..... $199
VGA 512K..... $299
VGA 1MEG $495

VOICE MAIL..... $245
PRINTER CARD..... $35
EGA CARD..... $139
2 WAY FDD CONT. (360K)..... $49
RS232 SERIAL/ CARD..... $49
GAMES..... $29
AT S/P GAMES..... $35
4 WAY FDD CONT. (360-1.44M)..... $129.
2 WAY FDD CONT. (360-1.44M)..... $80
CLOCK CARD..... $49
SMART DRIVE ADAPTER IDE/FDC..... $89
SMART DRIVE ADAPTER IDE I/O /FDC... $119

SAVE $7

RS232 MINI TESTER

- Male to female connections
- All pin wired straight through
- Dual colour LED indicates activity and direction on 7 lines
- No batteries or power required

T D Transmit Data
D S R Data Set Ready
R D Receive Data
C D Carrier Detect
R T S Request to Send
D T R Data Terminal Ready
C T S Clear to Send

Cat X15656 **Normally $39.95**
SPECIAL, ONLY $32.95

COPY HOLDER (YU-H32)

- Adjustable arms allows easy positioning
- Copy area 9 1/2" x 11"
- Sliding line guide
- Clamp mounting

C21062.....$39.95

COPY HOLDER (YU-H33)

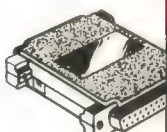
- Copy area 9½" x 11"
- Sliding line guide
- Flat metal base

C21060 ..... **$39.95**

CENTRONICS GEN CHANGERS

- Female to Female
- Saves modifying or replac non-mating Centronics cable
- All 36 pins wired straight th

Cat X15663 **Male to Male**
Cat X15661 **Male to Femal**
Cat X15664 **Female to Fem**
Normally
Only $



RS232 GENDE CHANGERS

- Saves modifying or replac non-mating RS232 cables
- All 25 pins wired straight

Cat X15650 **Male to Male**
Cat X15651 **Male to Fema**
Cat X15652 **Female to Fe**
Normally $14
Only

MOTHERBOAR

XT 10M MINI.....
XT 31M.....
XT 12M STD. SIZE.....
SUNTEC AT 12M.....
80386-25... W/CACHE
80386- 33... W/CACHE

ROD IRVI ELECTRON

SYDNEY: 74 Parramatta
Stanmore 2048
Phone (02) 519 3134
Fax (02) 519 3868

MELBOURNE: 48 A'Bec
Phone (03) 663 6151

NORTHCOTE: 425 High
Phone (03) 489 8866

CLAYTON: 56 Renver R
Phone (03) 543 7877

MAIL ORDER & CORRESPONDENCE:
P O Box 620, CLAYTON
Order Hotline 008 33 575
(Toll free, strictly orders o
Inquiries (03) 543 7877
Telex AA 151938
Fax: (03) 543 2648

MELBOURNE DEA
MICRODOT
177 SPRINGVALE RO
NUNAWADING. Ph.894

GREENSBOROUG
COMPUTERS
67 GRIMSHAW S
(cnr Howard st) Ph: 43

BRISBANE DEA
VRC COMPUTER SER
647 LUTWYCHE R
LUTWYCHE, 403

ADELAIDE DEA
MICROTRONICS
305 MORPHETT S
ADELAIDE, 5000

All sales tax exempt or wholesale inquiries to:
RITRONICS WHOLESA
56 Renver Road, Clayton
Phone (03) 543 2166 (3
Fax (03) 543 2648

Errors and omissions ex
Prices and specifications change

IBM* PC* XT* AT* are registered International Business Machines registered trademark *Denotes trademarks of their respective owner

MasterCard

008 335757 TOLL FREE MAIL ORDER HOTLINE FOR CREDIT CARD ORDERS!

QUALITY COMPONENTS

BNC PLUGS AND SOCKETS

BNC MALE PLUG

	1-9	10-99	100+
P10514	$2.50	$2.25	$1.50

BNC PANEL SOCKET

	1-9	10-99	100+
P10516	$2.50	$2.25	$1.50

BNC CRIMP PLUG

	1-9	10-99	100+
P10530	$2.95	$2.75	$2.00

BNC SOLDERLESS TWIST ON PLUG

	1-9	10-99	100+
P10531	$2.50	$2.25	$2.00

CANNON PLUGS AND SOCKETS

CANNON TYPE 3 PIN CHASSIS MALE

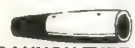
	1-9	10+	100+
P10962	$3.50	$2.95	$2.50

CANNON TYPE 3 PIN LINE FEMALE

	1-9	10+	100+
P10964	$3.95	$3.50	$2.90

CANNON TYPE 3 PIN CHASSIS FEMALE

	1-9	10+	100+
P10966	$4.95	$4.50	$3.50



CANNON TYPE 3 PIN LINE MALE

	1-9	10+	100+
P10960	$4.50	$3.50	$2.50

COMPUTER CABLES

- Six conductor shie
computer interfac
- m = metre

W12670 · CI

1-9 m	10	100+ m
$1.30m	$	$1.00m

W12672

1-9 m		100+ m
$1.60m		$1.20m

W12

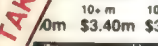
1-9 m	m	100+ m
$2	2.20m	$1.90m

W

· CIC16

	10+ m	100+ m
/8 · CIC25	$3.20m	$2.50m
0m	$3.40m	$3.00m

TAKE 25% OFF THESE PRICES



WIRELESS MICROPHONE

A10450.....$24.95

HEATSINK COMPOUND

Heatsink compound is applied to the base and mounting studs of transistors and diodes. It maintains a positive heatsink seal that improves heat transfer from the device to the heatsink, thus increasing overall efficiency.

H11800..10g.....$2.00
H11810..150g....$14.95

ULTRASONIC TRANDUCERS

Designed to transmit at 40kHz (L 19990) and recieve at 40 kHz (L 19991)with up to 20V I/P on the transmitter. These units can't be heard so are ideal for TV remote control's , water level detectors, burglar alarms, motion detectors and information carriers as they can be either pulsed or used in a continuos wave mode.

Transmitter	1-9	10+
L19990.....	$3.95	$2.95

Receiver

L19991....	$3.95	$2.95

PCB MOUNTING SCREW TERMINALS
(INTERLOCKING ENDS)

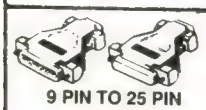
These terminals feature interlocking ends to form any number of conections. Standard 5mm spacing pins

· P10520 2 way

1-9	10+	100+
$0.60	$0.50	$0.40

· P10521 3way

1-9	10+	100+
$0.80	$0.70	$0.60



9 PIN TO 25 PIN CONNECTOR ADAPTORS

The perfect solution! Features gold plated pins
X15668 DB9 Plug to DB25 Socket
X15669 DB9 Socket to DB25 Plug.

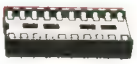
each $8.95

UTILITY BOXES

Plastic boxes with plastic tops and available in 5 sizes. Very popular fro projects & very economical

	1-9	10+
· 150 x 90 x 50mm		
H10111.....	$4.95	$4.75
· 195 x 113 x 60mm		
H10112.....	$5.75	$5.25
· 130 x 68 x 41mm		
H10113.....	$2.95	$2.50
· 83 x 54 x 28mm		
H10115.....	$2.25	$1.95
· 120 x 65 x 38mm		
H10120.....	$2.95	$2.50

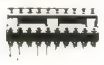
IC SOCKETS



LOW PROFILE IC SOCKETS

Save a small fortune on these "Direct Import" low profile ic sockets! PCB mounting solder tail. All tin plated phosphor bronze or berryllium and dual wipe for reliability.

Cat. No.	Description	1-9	10-99	100+
P10550	8 pin	15¢	12¢	10¢
P10560	14 pin	20¢	18¢	15¢
P10565	16 pin.	20¢	18¢	16¢
P10567	18 pin	30¢	25¢	22¢
P10568	20 pin.	35¢	30¢	25¢
P10569	22 pin	35¢	30¢	26¢
P10570	24 pin.	35¢	30¢	26¢
P10572	28 pin.	45¢	35¢	30¢
P10575	40 pin	45¢	40¢	35¢

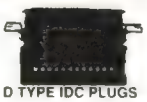


WIRE WRAP IC SOCKETS

These quality 3 level wire wrap sockets are tin-plated phosphor bronze.

	1-9	10+
P10579	8 pin	1.50	1.40
P10580	14 pin	1.85	1.70
P10585	16 pin	1.95	1.80
P10587	18 pin	1.95	1.80
P10590	20 pin	2.95	2.75
P10592	22pin	2.95	2.70
P10594	24 pin	3.95	3.50
P10596	28 pin	3.95	3.50
P10598	40 pin	4.95	4.50

IDC PLUGS AND SOCKETS



D TYPE IDC PLUGS

	1-9	10+	100+
· DE9P 9 pin plug			
P12166	$2.95	$2.50	$2.00
· DA15P 15 pin plug			
P12168	$3.50	$3.00	$2.50
· DB25P 25 pin plug			
P12170	$4.50	$3.95	$3.50

D TYPE IDC SOCKETS

	1-9	10+	100+
· DE9S 9 pin socket			
P12167	$2.95	$2.50	$2.00
· DA15S 15 pin socket			
P12169	$3.50	$3.00	$2.50
· DB25S 25 pin socket			
P12171	$4.50	$3.95	$3.50

IDC CENTRONICS 36 WAY PLUG & SOCKET

		1-9	10+	100+
· Plug	P12200	$3.95	$3.00	$2.95
· Socket	P12201	$3.95	$3.00	$2.95

ELECTRET MIC INSERTS

With pins for easy board insertion
Cat C10170

1-9	10+	100+
$1.20	$1.00	$0.90

CRYSTAL LOCKED WIRELESS MICROPHONE & RECIEVER

MICROPHONE SPECS:
Transmitting Frequency: 37.1MHz
Transmitting system: Crystal oscillation.
Microphone : Electret condenser
Power supply:9V battery
Range. 300 feet in open field
RECIEVER SPECS:
Receiver freq: 37.1MHz
Output level: 37mV(max)
Receiving sys: Super crystal oscillation
Power sup: 9V battery
Volume control: Tuning Led
Dimmensions:115x32x44mm
Weight: 220grams

A10452.....$99

DATA TRANSFER SWITCHES

If you have 2 or 4 compatable devices that need to share a third or fifth, then these inexpencivedata tranfer will save youthe time and hassle of constantly changing cables and leads around.
No power required
Speed and code tranparent
Two or four position rotary switch on front panel.
Switch comes standard with female connector.

RS232- 2 way	$39
RS232- 4 way	$59
RS232- X over	$69
RS232- 2 way auto	$69
Centronics- 2 way	$49
Centronics- 4 way	$69
Centronics- X over	$69
Centronics- 2 way auto	$79

ECONOMY TRANSFORMERS

	1-9	10+
2155 240V 6-15V 1A		
Cat M12155	$8.95	$7.95
2156 240V 6-15V A2		
Cat M12156	$13.95	$12.95
2840 240V 9VCT		
Cat M12840	$4.95	$3.95
2851 240V 12-6V CT 250mA		
CatM12851	$4.95	$4.50
2860 240 V 15VCT 250m A		
Cat M 12860	$4.95	$4.50
6672 240V 15 30vc 1A tapped		
Cat M16672	$12.95	$11.95

12V DC FANS

80 x 80 x 25.4mm
12V DC, 1.7 Watt, 0.14 Amps

T12469.....$12.95

10+ fans only $11.95 each

FANS

Quality, fans for use in power amps, computers, hotspot cooling etc. Anywhere you need plenty of air

240V 4.5-8"	T12461	$12.95
115V 4.5-8"	T12463	$12.95
240V 3.1 2"	T12465	$12.95
115V 3.1 2"	T12467	$12.95

10+ fans (mixed) only $10.95 each

LEDS

QUALITY 3MM LEDS

	1-9	10-99	100+
Z10140(R)	$0.15	$0.12	$0.10
Z10141(G)	$0.20	$0.25	$0.12
Z10143(Y)	$0.20	$0.15	$0.12
Z10145(O)	$0.20	$0.15	$0.12

QUALITY 5MM LEDS

	1-9	10-99	100+
Z10150(R)	$0.15	$0.10	$0.10
Z10151(G)	$0.20	$0.15	$0.12
Z10152(Y)	$0.20	$0.15	$0.12

FLASHING LEDS

red 5mm	1-9	10+
Z10159	$1.10	$1.00

RECTANGULAR LEDS

	1-9	10-99	100+
RED	20c	15c	12c
GREEN	20c	15c	12c
YELLOW	20c	15c	12c
ORANGE	20c	15c	12c

PANEL METERS GALORE

We have a great range of panel meters at great prices!

Q10500	MU45 0-1m A	$12.50
Q10502	MU45 50/50uA	$12.50
Q10504	MU45 0-100uA	$12.50
Q10510	MU45 0-5A	$12.50
Q10518	MU45 0-1A	$12.50
Q10520	MU45 0-1A	$12.50
Q10525	MU45 0-20V	$12.50
Q10530	MU52E 0-1A	$14.50
Q10533	MU52E 0-5A	$14.95
Q10535	MU45 VUP	$14.95
Q10538	MU65 0-50uA	$16.95
Q10540	MU65 0-1mA	$16.95
Q10550	MU65 0-100uA	$16.95
Q10560	MU650-20V	$16.95

MOSFET SPECIALS

	1-9	10+
2SJ49	$7.50	$7.00
2SJ56	$10.00	$9.50
2SK134	$6.90	$6.50
2SK176	$9.50	$8.90

VOLTAGE REGULATORS BARGAINS

Description	1-9	10+
7805UC	$0.50	$0.45
7812UC	$0.50	$0.45
7815UC	$0.50	$0.45
7905UC	$0.60	$0.55
7912UC	$0.60	$0.55
7915UC	$0.60	$0.55
78L05	$0.40	$0.30
78L12	$0.40	$0.30
LM324	$1.00	$0.90
555	$0.40	$0.30
741	$0.50	$0.45

DB25 CONNECTOR SPECIALS

		1-9	10+
P10885	DE9S	$1.00	$ 0.70
P10890	DA15P	$1.00	$0.70
P10891	DA15S	$1.00	$0.70
P10892	DA15C	$1.00	$0.80
P10890	DA15P	$1.00	$0.80
P10895	DA15S	$1.00	$0.80
P10902	DB25C	$1.00	$0.80
P10905	DB25P	$1.00	$0.80
P10905	DB25S	$1.00	$0.80
P10910	DE9P	$1.00	$0.80

HAVE YOU RECEIVED YOUR NEW 148 PAGE ROD IRVING ELECTRONIC CATALOGUE WITH 32 PAGES OF DATA. FREE WITH ORDERS OVER $100.

TOGGLE SWITCHES

		1-9	10-99
S11010	D.P.D.T	$1.20	$1.10
S11020	D.P.D.T	$1.30	$1.20

NICADS

Save a fortune on expensive throw away batteries with these quality Nicads and Rechargers!

Size	Desc.	1-9	10+	100+
AA	450mAH	$1.95	$1.75	$1.50
C	1 2 A H	$9.95	$9.50	$8.95
D	1 2 A H	$9.95	$9.50	$8.95

HORNS

SUPER HORN TWEETER

Requires no crossover and handles up to 100 Watts
Sensitivity: 100dB/ 0.5 m
Frequency response: 3kHz-3-0kHz
Independence: 8 ohms.
Size 96 m diameter
Normally $12.95

ONLY.....$9.95

10W HORN SPEAKERS

White durable plastic, 8 ohms
Cat. C12010 Normally $11.95

$9.95

MAIL ORDER & CORRESPONDENCE

P.O. Box 620, Clayton, 3168
Order Hotline: 008 33 5757
(Toll Free Strictly orders only)

POSTAGE RATES

$1 - $9.99	$3.00
$10 - 24.00	$3.50
$25 - $49.99	$4.50
$50 - $99.99	$6.00
$100 - $199	$7.00
$200 - $500	FREE
$500 Plus	FREE

The above postage rates are for basic postage only. Road freight, bulky and fragile items will be charged at different rates.

ROD IRVING ELECTRONICS

CITY: 48 A'BECKETT ST, MELBOURNE PH: (03) 663 6151 FAX: (03) 639 1641
NORTHCOTE: 425 HIGH ST, NORTHCOTE PH: (03) 489 8866 FAX: AS PHONE.
SYDNEY: 74 PARRAMATTA RD, STANMORE PH: (02) 519 3134 FAX: (02) 519 3868
MAIL ORDER: 56 RENVER RD, CLAYTON PH: (03) 543 7877 FAX: (03) 543 2648

All sales tax exempt orders and wholesale inquiries to:
RITRONICS WHOLESALE.
56 Renver Road, Clayton
Phone (03) 543 2166 (3 lines)
Fax (03) 543 2648

Errors and omissions excepted
Prices and specifications subject to change
IBM® PC® XT® AT® are registered trademarks of International Business Machines Apple is a registered trademark Dennes registered trademarks of their respective owners

ROD IRVING ELECTRONICS

The Story of Electrical Energy, Pt.8

The largest hydroelectric machines in Tasmania are in the Gordon River underground power station, in the rugged south western region. The subject of much controversy in the past, it is an impressive project by any standard.

By BRYAN MAHER

Exposed to the never-ending moist gales of the roaring forties, the south-west corner of Tasmania boasts Australia's wettest temperate climate, with 200 rainy days each year. Flora and fauna, direct relics of ancient times, still thrive in the cold rainforests. Rugged parallel mountain ges lying in a north west to south easterly direction and broad valleys cut by inaccessible gorges posed a nearly impossible task for the surveyors and engineers.

Although recognised since World War 1, the hydroelectric potential of the Gordon River was not thoroughly investigated until 1961. In March of that year, a hydrology analysis station was established on the Serpentine River. Measurements of precipitation and runoff predicted that 500 to 1000MW could be generated from the Gordon, Huon and Serpent rivers.

That was easier said than done! reaching the site, let alone bring in heavy machinery, was a major fort. A rough access track, suita only for tracked vehicles, was c structed in 1960 to McPartlan P Helicopters were necessary to bu research stations on Lake Pedder the upper Huon River. The region accessible only in summer, wh snowfalls and driving south weste gales usually abated.

To verify the choice of dam site the Gordon (1.5km upstream from Serpentine confluence), a camp established. Here intensive survey geological mapping, exploratory t nelling and drilling occupied summers of 1963 and following ye

Approval by parliament in 196 the $185 million scheme started c struction destined to increase state's electricity supply by 23%. ambitious plan involved a 140-m high dam blocking the precipit gorge on the Gordon river. The square kilometres of Lake Gordon t formed would join an elevated sion of the existing Lake Pedde create Australia's largest fresh w storage. After a road was built to dam site in 1969, diversion tun were the next to be built.

Taken when the Gordon Dam was almost complete, this photo shows the extreme curvature of the structure - a classic concrete arch dam.

River diversion

To enable the building of the don Dam, the river had to be tem rarily diverted. This was done in stages in 1969/70. First, a reinfo concrete coffer dam was built stream from the main dam site. water thus impounded flo through a 350 metre long tunnel b through the gorge cliff, exiting down stream. Then a second s diversion was built closer to the d Subsequently, the first diversion nel was sealed with a concrete and the coffer dam demolished

ost dam projects require at least two dams, one a temporary coffer dam which
s construction start on the main dam. This upstream photo of the Gordon
m during construction shows the remains of the coffer dam after it had been
molished.

This photo shows the underground Gordon power station during construction. The inlet valve and turbine casing for the No.2 machine can be clearly seen.

1970. Similarly, the Serpentine River was diverted so its dam could be commenced.

As the region was totally uninhabited, Strathgordon Village was built to house the workforce, while design of a twin 220kV power line to the east commenced.

The proposed site of the underground power station proved to be unsuitable because of unfavourable rock structure. The geology of south west Tasmania consists of 700 million-year-old sandstone with limestone outcrops and ancient lava intrusions up to 300 metres thick.

A quarry and cement plant was built on a knob hill overlooking the river and roads were built to the bottom of the 400-metre deep gorge. Roads and an overhead cable way carried men and equipment to the dam site. Using twin haulageways and four tower cranes, by 1972 the first concrete was being poured in the Gordon Dam structure. The following year, the excavation of the re-sited underground power station began.

The Gordon Dam

Rising 140 metres above its foundations (higher than Sydney Harbour Bridge), the Gordon dam is a classic reinforced concrete arch; the largest of its kind in the southern hemisphere. Only 200 metres long, it tapers in thickness from 17.68 metres at the base to 2.74 metres at the top. Containing 280,000 tonnes of steel and concrete, the dam is constructed with its convex curvature facing upstream.

The arched design transfers mo of the water force onto the steep roc cliffs which form abutments on eac side. Begun in 1972, the dam wa completed in 1974, but it took 4 yea to fill. The weight of water exerts pressure of 1.4 megapascals (ie, 1 kilograms per square centimetre) the base of the dam wall. As the dam security depends on the stability the abutments, electronic transdu ers were buried within the concre wall. Computers in Hobart monit the electrical readings to constant assess the conditions.

At the same time as the dam wa being constructed, an 80-metre hig intake tower was built with an acce bridge above spillway water level. the top of the tower are controls f the 75-tonne cylinder gate valve located at the bottom, which contr the bulk water flow to the power st tion below. The flow of water (4 cubic metres/sec) can be total stopped, if need be, by the cylind valves in only 20 seconds.

Water falls via the 8.23m diamet shaft, then runs horizontally to t turbines, as the cross section diagram show. The 356-metre power tunn was completed in 1973 and the fo lowing year the dam began to fill.

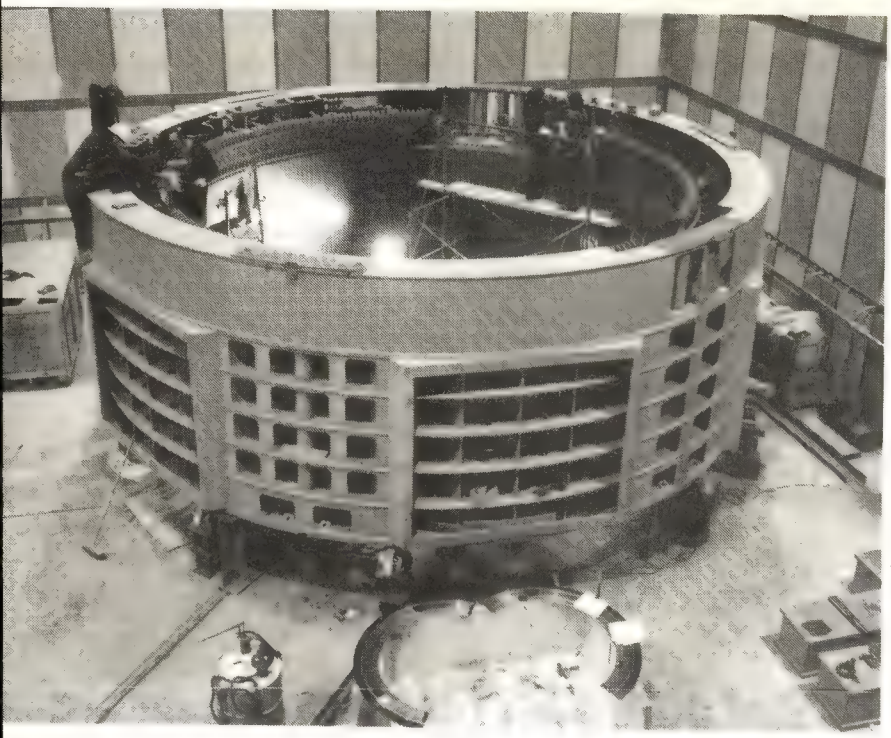
Underground turbine room

The construction of a power st tion within the bowels of a mounta tests the expertise and experience engineers to the limit. The procedu used was to excavate the undergrou turbine room from the top dow wards. The artificial cave was fi dug out down to crane rail level. T crane runway structures were set in the rock walls, then the cranes sembled and operated.

The work then consisted of diggi out the floor using tracked hydrau boring equipment until the full 3 metre depth was reached.

As machinery was set in place, t ing contractors then lined the ceili The walls were faced and lighti was set in place. Various floor lev were then constructed; above a below the alternators, at basement a above the turbine runner height.

Reinforced concrete busbar troug were built around the walls to hou the generator output conduct which run from each machine to t vertical shaft, thence up to the abo ground substation. The final appe



ydroelectric alternators are very big machines, especially compared to those iven by steam turbines. This is one of the stators in the Gordon Power Station.

ce of the main floor of the power tion, high above the top of the al- nators, is shown in one of the pho- s. Only the exciters are visible from e operating floor; stairways give cess down to all other levels.

Simultaneously with the turbine om construction, the boring of the let and outlet water tunnels pro- eded. As already noted, the inlet aft has a diameter of 8.23 metres. is main water conduit and the bran- ings to each turbine are lined with ncrete and a great deal of trouble s involved in obtaining smooth ntours throughout.

nooth contours

Smooth pipe contours are neces- y to obtain laminar water flow with nimum turbulence. Turbulent flow plies a severe energy loss which ıst be avoided for best efficiency d least wear in the tunnels and bines.

The cross section diagram of the wer station shows the water path- y. Controlling the flow through h turbine is a 2.8-metre diameter draulically operated rotary inlet ve. The station's two 90-tonne pacity cranes were used in tandem lift these 116-tonne valves into ce during construction. From each ve, the water flows into the tur- bine at a rate of 86 cubic metres per second.

Francis turbines

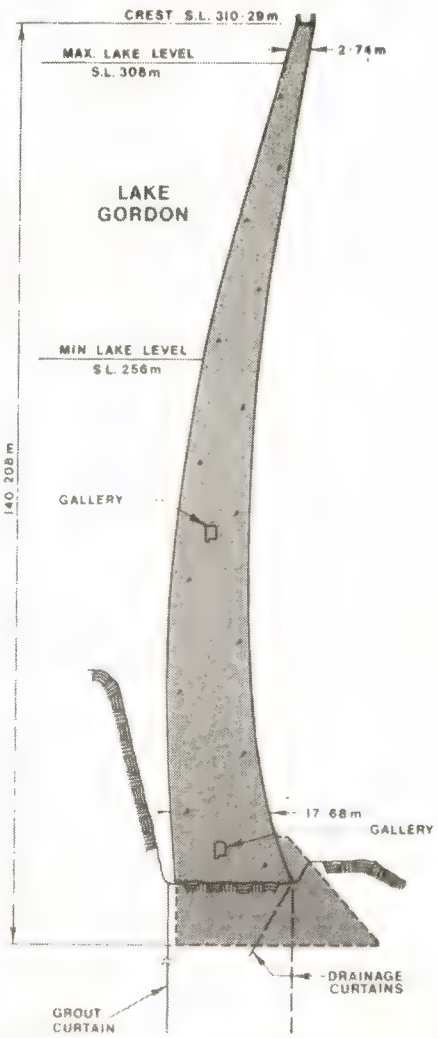
Each 150MW Francis vertical shaft water turbine consists of a welded steel spiral casing in which the turbine runner rotates. The 100-tonne spiral casings were fabricated in the HEC workshops and were then lifted into position and embedded in concrete. In operation, the water enters the spiral casing at the large diameter end. Flowing around the spiral towards the small diameter end, the water is forced to flow through the turbine runner before falling downwards. The water thus rotates the turbine and the direct coupled alternator above.

Each 3-metre diameter turbine runner, the most critical mechanical component, was cast by Fuji in one piece of stainless steel. These 23-tonne castings must have smooth blades polished almost to mirror finish to reduce water friction and enhance efficiency. The chromium component in the stainless steel alloy inhibits pitting and corrosion which would otherwise increase losses.

Each turbine runner is coupled by a long 22-tonne vertical shaft to the rotor of the alternator above. These 144MW generators were manufactured in Germany by Siemens and assembled on site. The heaviest component is the 269-tonne rotor; so heavy that it was lifted into place in sections by the two overhead travelling cranes. The 22-pole stators for each machine, weighing 168 tonnes when assembled, were lifted into position by both cranes.

When fully assembled, the total 314-tonne weight of the rotor, turbine and coupling shaft hangs on one vertical thrust bearing and is aligned by a number of guide bearings. So accurate is the alignment and so smooth the lubricated bearings that two men can turn the total rotating mass by hand (at a very slow speed of course).

Having done its work in turning the turbine, the water falls through the fabricated steel outlet draft tube to the tailrace tunnel. This huge conduit, 9 metres in diameter, carries the



The cross section of the Gordon Dam shows it to be a very thin structure, relative to its height. Note that it is curved vertically and horizontally.

This photo really does show the scale of the Gordon hydroelectric scheme. This is the 8.23-metre diameter inlet water tunnel with the three raceways running off to the left. Note how smooth the concrete is, to minimise turbulence.

total outlet water from all machines 1.6km downstream to the lower Gordon River.

Scale working model

To test the performance of the turbines and verify the design, the Fuji Electric Co of Japan constructed a true 1/8th scale working model. This model turbine used water flow and full load to ascertain the efficiency, speed characteristics, stresses, strains and the extent of cavitation.

In any turbine of the Francis or Kaplan types (as with ships' propellers), water flow patterns are critical. Cavitation means a non-ideal action wherein the turbine or propeller generates bubbles of water vapour close to the steel blades. As this water vapour is compressable (whereas liquid water is not), less than ideal forces act between turbine blade and bulk water. The result is that full power transfer cannot be realised from the machine.

Thermodynamic theory shows that there will always be some cavitation. However, this effect can be minimised by optimum design of blade dimension, shape and contour.

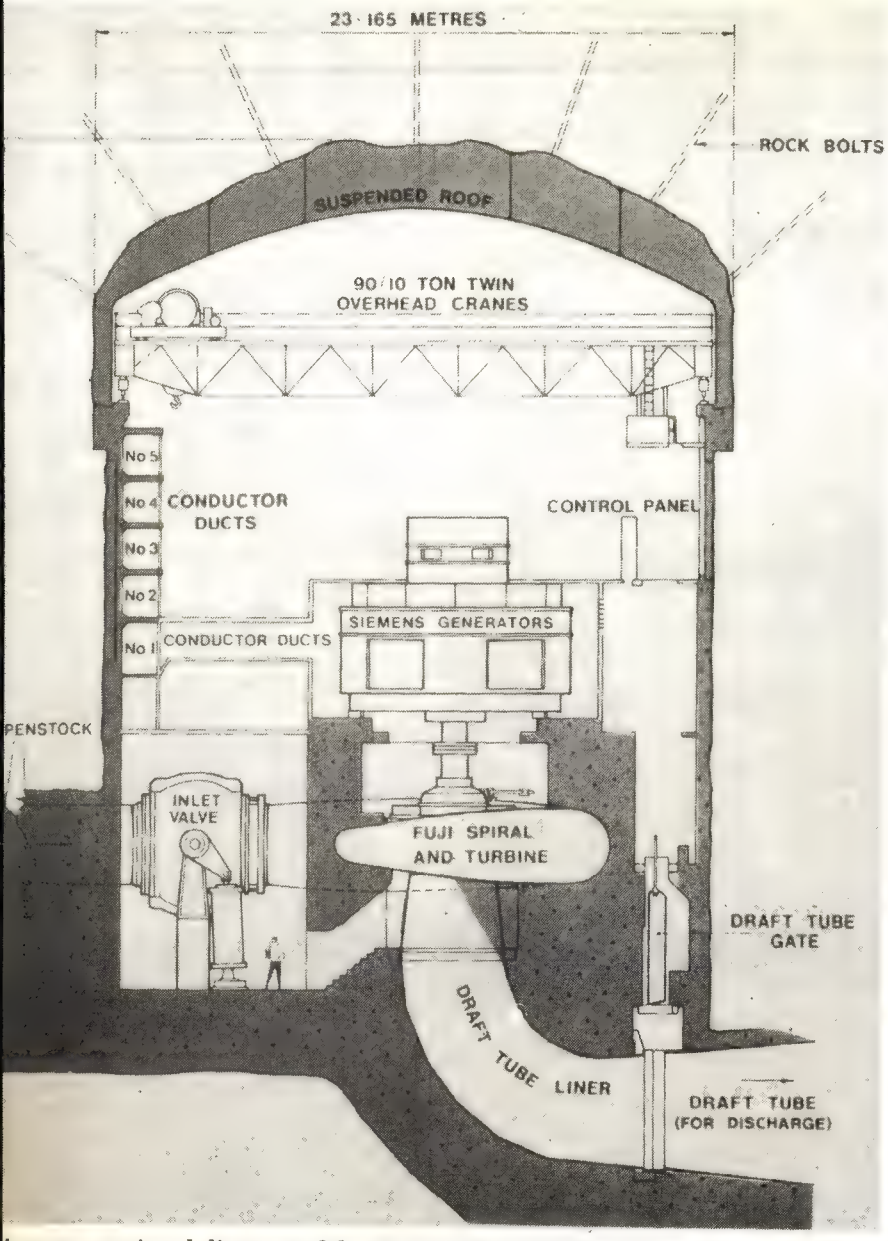
In operation, the generator runs at 272.7272 RPM (long term average). But as with all generators, the sudden application of a heavy load must cause a momentary reduction in speed until the water valve opens incrementally to compensate. Load reduction causes the reverse. However, the very heavy rotating mass of large hydroelectric generators provides a great spinning reserve of energy, helping to maintain system frequency during changes in load.

The 18kV 5000A 3-phase output of the alternators is carried by hollow square aluminium busbars throug 190-metre vertical lift shaft to aboveground substation. Here power is stepped up to 220kV transmission to Hobart. Each tra former weighs 194 tonnes, so hea that a special technique was used transport them to the site.

Carrying frames

Instead of an enormous trailer be used (which would be too long manoeuvrability) a special pair carrying frames were built. E 160MVA transformer was supplied the manufacturer, Reyrolle-Parso Wilson, complete with special tra porting frames. After being lifted fr ship to wharf, the triangular fra were bolted to the front and rea the transformer casing. Multiple r wheels supported each triang frame, while a heavy Pacific pr mover hauled the assembly.

The switchyard and power lin the Gordon regions were designe



is cross sectional diagram of the Gordon Power Station shows the scale of the oject. The station capacity is 432MW, with provision for two more machines.

end as much as possible with the enic surroundings. ACSR (Aluminm Conductor Steel Reinforced) nductors 25mm in diameter were ed for the twin power feeders, us- an average span length of 450 tres. In the sensitive Gordon River ions, towers were constructed of a ecial steel. This develops a uniim stable rust coating which inhibfurther corrosion. The dark colour nds successfully with natural surndings.

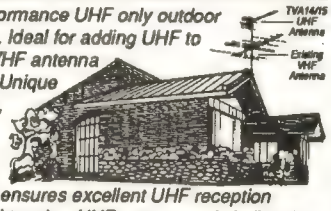
The first two generators were comted and commenced supplying d in 1978. Full load commercial eration was achieved in 1978/79. After 3½ years work and an expenditure of $38 million, the installation of the third turbogenerator at Gordon Power Station was completed in 1988. This raised the total station capacity to 432MW.

The station still has provision for two more machines. If installed, these would raise the available peak load output. However, the total output in a year would not be increased as this is limited by the rainfall and snowfall within the catchment area.

Lake Pedder

To supplement the water storage of Lake Gordon, the level of Lake Pedder was raised by the Serpentine and Scotts Peak dams and the small Edgar

UHF HIGH GAIN ANTENNAS



High performance UHF only outdoor antennas. Ideal for adding UHF to existing VHF antenna systems. Unique triangular, powder coated receiving elements ensures excellent UHF reception compared to other UHF antennas of similar size and price. Two models are available: the TVA14 for Band Four and the TVA15 for Band Five UHF reception. Both models are supplied with back reflectors to prevent ghosting as well as a waterproof entry box designed to accept 75 ohm coaxial cable without the need for additional baluns. They also have predrilled holes for securing the tilt adjustable metal mounting bracket in either a horizontal or vertical position.

Imported and distributed by:

ARISTA ELECTRONICS

Available through the following retailers:

Bernys. Bridgepoint. Military Road. Mosman. 2088. NSW. (02) 969 1966.

Ritronics. 56 Renver Rd. Clayton. Victoria. 3168. (03) 543 2166.

CHRISTIAN BLIND MISSION

Restoring sight to the blind

COUPON

Please cut and send to:
CHRISTIAN BLIND MISSION INTERNATIONAL, P.O. Box 5, 1245 Burke Road, KEW, Vic. 3101
Phone: (03)817-4566

☐ Please send me further information about CBMI's work.

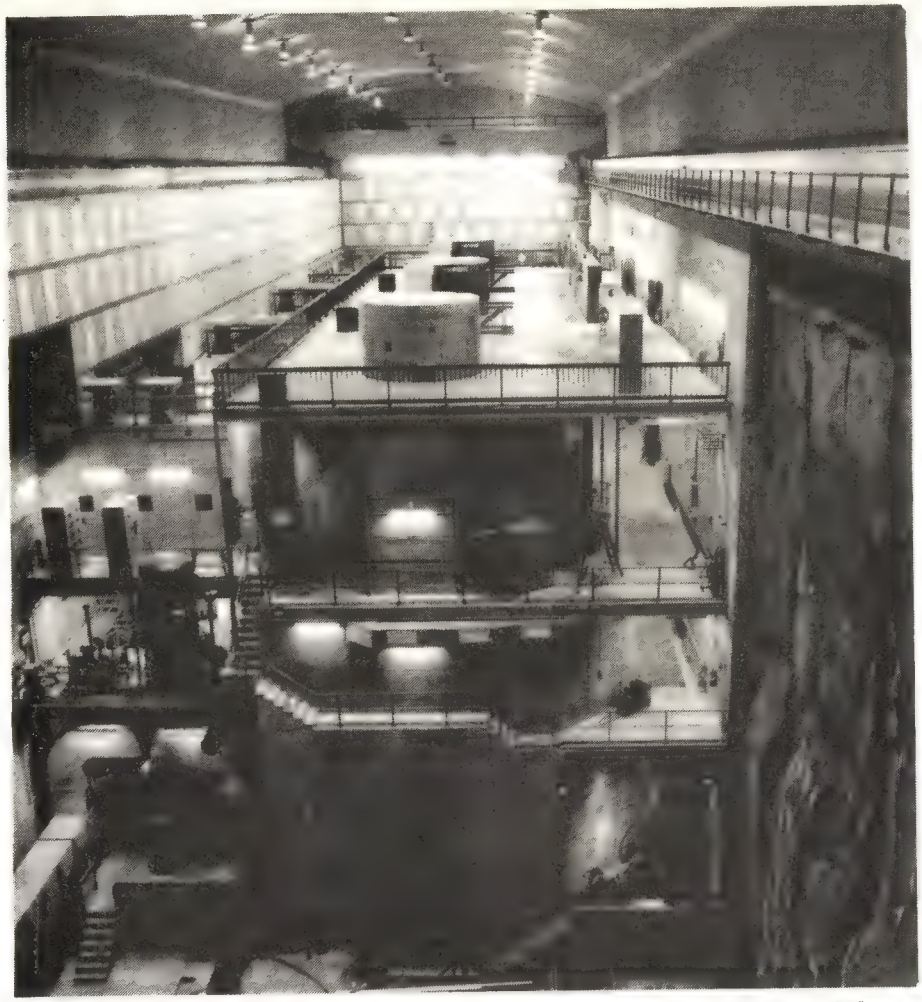
As long as it is possible for me, I will help:
☐ monthly ☐ quarterly ☐ annually
☐ to prevent blindness
☐ to restore eyesight
☐ to rehabilitate the blind

Enclosed is my gift of $ _____

Mr/Mrs/Miss: _____

Street: _____

City: _____ Postcode: _____



The third machine, installed in the Gordon Power Station in 1988, raised the station's maximum output to 432 megawatts.

Big alternators require big transformers and these cause big headaches in transportation. This photo shows the solution used for the Gordon power station transformers - a special carrying frame hauled by a heavy prime moved.

levee. Though much smaller than th Gordon, these two additional dan are an integral part of the scheme.

The Serpentine Dam, on the riv of the same name near Mt Sprent, is 38-metre high mass of concrete-face rockfill 131 metres long. Much bigg is the Scotts Peak Dam, just over kilometre in length but only 43 metr high and containing about a millio tonnes of rockfill under its concre skin. These two small dams, with t Edgar levee, impound the Lake Pe der catchment, raising the water approximately the same level as La Gordon.

The McPartlan Pass Canal, 2.66k long, was cut to allow water to flo either way between the two lak Normally water flows from Pedder Gordon but flood rains in the Gord catchment can also be stored in La Pedder.

The Tasmanian parliament and t Hydro Electric Commission reco nised that the intrusion of man in previously inaccessible wilderne regions must cause adverse effec Certainly the flooding of the sm but beautiful original Lake Pedd provoked serious environmental co troversy.

The Gordon power station contr utes a large percentage of the to state power loading which reach an all-time peak of 1.4505 Gigawa in June 1989.

The control of the entire Tasmani hydroelectric system requires ma factors to be taken into account. N only must power be immediat available at all times but also wa resources must be carefully h banded. Accurate weather foreca must be taken into account. The factors and other Tasmanian dams a power stations will be investigated a later chapter of this series.

References

(1). Tasmanian HEC literature.
(2). "Australia the Beautiful Wild ness"; Bob Brown.
(3). "Australia's Wilderness Herita Vol.1; Geoff Mosley.
(4). "Australia the Greatest Islan Robert Raymond.

Acknowledgements

Grateful thanks to the Tasman Hydroelectric Commission and to Emson for data, photos and perm sion to publish.

SILICON CHIP ORDER FORM

USE THIS FORM FOR ALL YOUR SILICON CHIP ORDERS

UBSCRIPTION:

☐ NEW SUBSCRIPTION: Month To Start_____

☐ RENEWAL: Sub No._____Start In_____

☐ GIFT SUBSCRIPTION: Month To Start_____

GIFT SUBSCRIPTION DETAILS

r/Mrs/Ms:_____

ddress:_____

_____

_____Postcode_____

RATES:

(PLEASE TICK ONE)	2 YEARS (24 ISSUES)	1 YEAR (12 ISSUES)
Australia	☐$A84	☐$A42
Australia With Binder	☐$A105	☐$A53
NZ & PNG (Airmail)	☐$A130	☐$A65
Overseas Surface Mail	☐$A130	☐$A62
Overseas Airmail	☐$A240	☐$A120

ILICON CHIP BINDERS

es! Please send me_____SILICON CHIP binder(s) at $A14.95 each

ncluding postage) TOTAL $_____

(Overseas Orders add $A3 each for postage)

SPORTS SHIRT

Please send me_____Sports Shirt(s) @$A24.95 including postage (NZ add $A3)

Size:_____S, M, L, XL, XXL Total $A_____

SLOPPY JOE

Please send me_____Sloppy Joe(s) @$A27.95 including postage (NZ add $A3)

Size:_____S, M, L, XL, XXL Total $A_____

BACK ISSUES: $A5.00 each (includes postage). Overseas orders add $A1.00 per issue for postage.

ISSUE	YEAR	ISSUE	YEAR	ISSUE	YEAR	ISSUE	YEAR
						TOTAL $A	

nclosed is my cheque/money order for $_____

please debit my ☐ VISA ☐ MasterCard

ard No.

Card expiry date

gnature_____ _____ _____Postcode:_____

Mr/Mrs/Ms:_____

Address:_____

_____

24 Hour Fax Service
(02) 979 6503
Send the coupon with your Credit Card Details.
24 Hours, 7 Days a week.

Subscription Hotline
Telephone (02) 979 5644
9am-5pm Mon-Fri
and quote your Bankcard, Visa Card or MasterCard No. and expiry date.

Detach and Mail to:
FREEPOST 25
SILICON CHIP PUBLICATIONS
PO BOX 139
COLLAROY BEACH NSW 2097
No stamp required in Australia

ASK SILICON CHIP

Got a technical problem? Can't understand a piece of jargon or some technical principle? Drop us a line and we'll answer your question. Write to: Ask Silicon Chip, PO Box 139, Collaroy Beach, NSW 2097.

Sick Jaguar needs better spark

I have built and installed the High Energy Ignition System (described in May 1988) on my Renault and I am very happy with it. Now, I am considering installing a similar system on my 1983 Jaguar since it has not been performing as well as it should of late. However, before I proceed, I need some additional information.

The Jaguar handbook makes reference to the system having a 6V coil, and then later on, to a 12V coil. I am confused and the Jaguar people here do not seem to be able to give a clear answer. The coil also seems to get very hot. On some occasions the car has refused to pull away from a stop and has even stalled. It then starts and drives as normal. A new coil is very expensive, by the way, at around $200.00.

Hence, my thoughts about changing the ignition system. Will the high energy ignition system work with a 6V coil? And how do I hook it up to the breakerless distributor on the car? (J. E., Melbourne, Vic).

• In the past, we have been asked whether the High Energy Ignition System will work on 6V cars and our reply has been that, as far as we know, it will work without modifications. In your case, however, we must urge caution.

We really think that, in spite of the expense, your best approach is to consult an auto electrician who is familiar with Jaguar ignition systems an get it fixed. You could be asking for lot of trouble in hooking up the SIL CON CHIP ignition design to a c which already has a breakerless ign tion fitted and one which has a rep tation for using specialised parts.

Ignition kill switch to be triggered by oil loss

I have an idea for using a normal closed relay to switch the line to t ignition system in the event of pressure loss. One side of the rel coil would be connected to the po tive side of the ignition coil prima winding while the other side wou connect to the oil pressure light the dash.

Big bang for big bucks

Having just read about the DC-DC converter featured in the December 1990 issue of SILICON CHIP, you have just filled one of the many holes in my limited electronics knowledge. It has urged me to find out more.

At present I am looking down the barrel of an $800 subwoofer setup to complement my high-powered Alpine car audio system. This leads me to my ponderings: How would a famous brand 10-inch woofer (22Hz-12kHz, 89db/W/m, unknown R) for a car compare with a Dick Smith 12-inch driver (25Hz free air resonance, 96dB/W/0.5m, 8Ω), both driven by a bridged 200W car amplifier?

I have noticed that some home style drivers look quite wimpy in the magnet department when up against their road-going counterparts. Is this to compensate for the lack of damping provided by the voluminous Aussie car boot?

My second component hurdle is the crossover. I have a copy of Richard Kaufman's "Enhanced Sound" in which he almost enticed me into building a 112Hz asymmetrical crossover but to my horror, it had to have a dual polarity supply for the three TL072s involved. How can I substitute the TL072s for 12V single polarity ICs and still be as simple as in the book?

Your DC-DC converter story mentioned a 100W amplifier module from a previous edition of your magazine. I assume that when this amplifier is matched to your converter, the 100W rating is into 8Ω. What would happen when this combination drove a 4Ω speaker, as used in car audio? (C. A., Babina, Qld).

• OK, we'll answer your questions in order. The problem with comparing different speaker drivers is that you are comparing apples and oranges. Both may sound (taste?) pretty good when installed in the correct enclosure and it becomes important to ask about power handling and efficiency. Car speakers are often quite inefficient but, as you have noted, they often have really big magnets and a stiff suspension to make up for the lack of correct baffling.

Converting your crossover circuitry to 12V single supply operation happens to be quite easy in this case. All you do is connect two 22kΩ resistors in series across the 12V supply and a 22µF capacitor from the centrepoint to the 0V line. This then becomes a bypassed 6V supply to feed the non-inverting (+) inputs of op amps IC1 and IC2.

The 100W module referred to in the DC-DC Converter article was the one described in the December issue of SILICON CHIP and it delivered that power into a 4Ω load from ±40V rails. The Studio 200 stereo power amplifier used the same modules but with higher rated transistors and ±50V rails and was rated at 100W into 8Ω loads. Depending on the power supply regulation, it can deliver up to 190 watts into a 4Ω load.

Having said all that, we suggest you hang off for a bit on your subwoofer project. We hope to do one in the next four or five months.

A diode would be connected in es with the relay coil to prevent oil pressure light from getting a se' ground through the ignition coil points. A pushbutton switch also ds to be included to allow the icle to start, because the oil pres- e is zero when the motor is sta- ary. The button has to be held in il the oil pressure light goes out. What do you think of the idea? (A. Browns Plains, Qld).

o be brutally honest, we don't think ch of the idea at all. For a start, it uires the use of a pushbutton to ble the relay while the vehicle is g started. This may be OK when are starting the engine at the be- ning of a journey. But what hap- s if the vehicle stalls in traffic and suddenly need to restart the en- e? You could easily forget to press button and thereby be subject to nsiderable amount of hassle.

econd, what happens if the oil sure switch itself fails? In our erience, this is actually more mon than a loss of oil pressure. metimes too, it is possible to have omentary loss of oil pressure while er heavy braking or during fast ering. Would you want the en- to stop then?

ith a normal car, if the oil pres- switch fails or if the engine does oil pressure, you can at least keep ing until it is safe to stop and k the problem. With your scheme, engine would stop whether you d it or not.

you are really concerned about of oil pressure, we suggest that install a pressure gauge and per- s an audible alarm which could connected to the oil pressure ch. That way, even if the oil pres- switch does malfunction, the oil sure gauge will tell the true story.

nts to build table timebase

am interested in building a very e timebase which could operate MHz or 10MHz with a stability of ast one part in 10^7. Has SILICON ever published such a project if not, do you have any plans for a project? (G. E., Dorrigo. NSW).

e have not published any circuits g these lines and do not have any s to do so at present. We also der if there is much point in building a traditional timebase. A crystal oscillator running in a temperature stabilised oven may well have a frequency stability of a few parts in 10 million but isn't that a bit old hat? Why not go a lot better and strive for the accuracy of a Caesium beam clock - 3 or 4 orders of magnitude better?

Most, if not all, television networks in Australia are tied to a Caesium beam clock. This means that if you measure the colour subcarrier frequency (4.43361875MHz) from your local TV station when it is connected to the National network, you have a frequency reference of excellent accuracy. All you need is a small colour TV set and a circuit to buffer the 4.43MHz crystal oscillator.

If enough of our readers are interested in such a project (write and tell us), we'll do it.

Difficult reception in remote Tasmania

I live in a north/south valley only about 20km west from Hobart's Mt Wellington (as the crow flies) where all the TV transmitters are located. But my TV reception is lousy on all three channels, both VHF and UHF, because my house is on the eastern slope at almost the lowest point in the valley.

All the TV antenna and antenna installation books in general deal with "line of sight" installations only. I am sure there must be literally hundreds of TV users around Australia in the same predicament as myself. There are hills on the opposite side of the valley which bring in good reception from the top. I don't want to install about a kilometre of cable plus supply cable for line boosters. At that cost, I'd be better off opting for "space TV".

Could one install a reflector and what size and type would be best? Is there any other option? (P. T., Tullah, Tasmania).

• You are right that there are many people in your predicament but in your case, there does seem to be a chance of a solution. You mention a hill on the opposite side of the valley where there is good reception. Why not use the hill as your reflector? Aim your TV antenna directly up to the top of the hill. If the signal up there is strong, you may well find that sufficient signal is reflected down to you to give reasonable reception.

There is nothing new in this technique and it is often used by antenna installers in difficult hilly areas.

UHF converter for old TV set

I have recently acquired an old colour TV set that does not receive the UHF band. I want to watch SBS and so need a UHF to VHF converter. I know that such units are commercially available but building is more fun and perhaps a wee bit cheaper.

I do hope that you can service this request as I do like to watch SBS. (R. J., Balmain, NSW).

• We have not described a UHF converter and we are not inclined to think that such a project would be popular. The reason? First, not enough people with old TV sets want to watch programs on UHF and second, most people have a VCR anyway. And that is probably the cheapest and best way to get a converter, since just about all VCRs have a UHF tuner as standard.

We suggest you get a new VCR (or even an old VCR with a worn out transport mechanism) and your problem will be solved.

Expander for tape player

I built the CD Compressor described in the March 1989 issue of SILICON CHIP and it worked first time. In fact, it works so well that I use it not only to compress from CD to tape but to compress the vocals in our band.

Are you considering bringing out an expander so we can play our tapes on the hifi and so bring back the original dynamic range? I built a compressor expander many years ago but the distortion was abysmal.

Thank you for replying to my previous letter about feedback (see "Cur-

continued on page 104

MARKET CENTRE

Cash in your surplus gear. Advertise it here in Silicon Chip.

CLASSIFIED ADVERTISING RATES

Advertising rates for this page: Classified ads - $7.00 for up to 15 words plus 40 cents for each additional word. Display ads (casual rate) - $20 per column centimetre (Max. 10cm).

Closing date: five weeks prior to month of sale. If you use a PO Box number, you must include your permanent address and phone number for our files. We cannot accept ads submitted without this information.

To run your classified ad, print clearly on the lines below or on a separate sheet of paper & send the form together with your cheque or credit card details to : Silicon Chip Classifieds, PO Box 139, Collaroy Beach, NSW 2097. Or fax the details to (02) 979 6503.

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

_____ _____ _____ _____ _____

Enclosed is my cheque/money order for $_____ or please debit my

❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | | |

Signature_____ Card expiry date_____/_____

Name _____

Street _____

Suburb/town _____ Postcode_____

FOR SALE

WEATHER FAX programs for IBM ATs *** "RADFAX2" is a high resoluti shortwave weather fax, Morse & RT receiving program. Needs CGA, S HF radio & Radfax decoder. A "RF2HERC", "RF2EGA" & "RF2VG same as RADFAX2 but suitable Hercules, EGA & VGA cards resp tively. $35. *** "SATFAX" is a NO Meteor & GMS weather satellite ture receiving program. Uses EG VGA modes, needs EGA or VGA our monitor & card, plus "WEATH FAX" PC card. $45. *** All progra are on 5.25-inch or 3.5-inch discs (s which) & include documentation. $3 postage. ONLY from M. Delahu 42 Villiers St, New Farm, 4005 Phone (07) 358 2785.

BWD OSCILLOSCOPE, 35MHz Trace, Model 830. As brand new. $1600, sell for $900 (no offers). C tact Claude on (086) 28 2435 anyti

MY AUSTRALIAN DESIGNED cost super-fast Z80 micro-contro development system has gained ceptance already with educationa stitutions. Pop it on the end of any MSDOS or Z80 machine and away go. Boards, EPROM and 360K $76 including postage for a short kit. Gee, I wish I had this when I w

IIT MATHS FASTER FOR L

COPROCESSORS

2C-08	2C87- 8MHZ	$330
2C-10	2C87-10MHZ	$359
2C-12	2C87-12MHZ	$430
2C-20	2C87-20MHZ	$490
3C-16	3C87-16MHZ	$640
3C-20	3C87-20MHZ	$680
3C-25	3C87-25MHZ	$840
3C-33	3C87-33MHZ	$990

These pices include Sales Tax. Stock are limited at this price, so order earl

FIVE YEAR WARRANT

CAD CONNECTION
PHONE (02)957 6719
FAX (02)954 5550

CA CONNECTI

MEMORY EXPANSION

Prices At Sept. 13, 1990

IMM & SIP			CO-PROCESSORS
x 256	-120ns	N/A	8087-2
	-100ns	23.00	80287-10
	- 80ns	23.80	80C287-12
	- 70ns	24.70	387SX-16
	- 60ns	30.00	387DX-16
x 1MB	-100ns	79.00	387SX-20
	- 80ns	81.50	387DX-20
	- 70ns	89.50	387DX-25
x 1MB(MAC)	- 80ns	76.50	387DX-33
	- 70ns	82.00	
x 4MB	- 80ns	528.00	387SX-16
			387DX-20
			387DX-33
RAM/DIP			
64	-100ns	2.10	
256	- 80ns	2.40	3167-20
464	- 80ns	2.50	3167-33
x 256	- 80ns	7.65	4167-25
MB	- 80ns	7.65	4167-33

INTEL			
175.00			
308.00			
390.00			
435.00			
478.00			
490.00			
538.00			
680.00			
835.00			
CYRIX			
400.00			
490.00			
750.00			
WEITEK			
820.00			
1010.00			
1500.00			
1780.00			

TOSHIBA LAPTOP		
T1000SE	2MB	515.00
T1600	2MB	340.00
T3100E	2MB	340.00
T3100SX	2MB	340.00
T3200SX	2MB	340.00
T3200	3MB	570.00
T5100	2MB	340.00
T5200	2MB	340.00
COMPAQ		
386-20, 386-25, 386-20E, 386-S, 386-33		
4MB MODULES		680.00
4MB BOArds		798.00
IBM PS/2		
30/286,50	2MB	250.00
70E61,121	2MB	280.00
70A21	2MB	280.00

Sales Tax 20%. Overnight Delivery. Credit Cards Welcome
1st Floor, 100 Yarrara Road, Pennant Hills, NSW 2120.
Tel (02) 980 6988 Fax (02) 980 6991

PELHAM

TOROID POWER TRANSFORMERS

From quality UK manufacturers. Available from stock at discount prices, 15VA to 625VA. Send SSAE for data & prices to:

Transformer Discounters,
PO Box 542, Wahroonga 2076.

ACTIVE SHORTWAVE ANTENNA
SILICON CHIP, JAN 1990. Complete kit $59.00, Built and Tested $119.00, Case $10.00.

LOOP ANTENNA
Improve signal strength & quality with this portable antenna. Kit $44.00, Built and Tested $69.00

COMPACT INDOOR FM ANTENNAS
Two models to choose from, Terk FM2000 a passive loop FM antenna for $69.95 or the Terk PI2 powered FM antenna with wideband low noise filter for $199.00.

We can also provide assembly facilities for small production runs at competitive prices

JILOA (TECHNIKIT DIVISION)
PO Box 73, Glenhuntly, VIC 3163.
Telephone: (03) 571 6303

MAX I/O Board
Kit $169.00 Built & Tested $269.00
x Relays SPST 2 amps each
x Switch inputs (TTL)
x DAC (Digital to Analog converter)
x ADC (Analog to Digital converter)
x Motor Drive outputs (40mA ea.)
x Programmable timer output.
X includes a 20 page manual with all schematics, s layout etc., a 360K PC compatible floppy with nostic and sample software in GW-Basic. MAX s from a PC compatible Printer pert for full patibility with a large range of computers. Same dispatch of orders. Credit cards or personal cheque come.
ne: (08) 332 6513 or Fax: (08) 364 0902 (24 hours)
Computers 36 Regent St,Kensington, SA,

KIT REPAIRS

Kits repaired from all magazines. PCs and peripherals also repaired
Ring anytime 9am - 9pm

EEM ELECTRONICS
10 Bouverie Place
Epping Vic. 3076
(03) 401 1393

LEARN WITH UCANDO TRAINING COMPUTER ANIMATED VIDEOS

VT201 53 Mins DC Circuits	$75.42
VT202 71 Mins AC Circuits	$79.54
VT203 54 Mins VCR Maint.	$75.42
VT204 110 Mins VCR Repair	$114.97
VT205 47 Mins Semiconductors	$75.42
VT206 55 Mins Power Supplies	$75.42
VT207 54 Mins Amplifiers	$75.42

Mastercard/Visa/NZ Cheque to:
Electronics Assembly Company
PO Box 21191, Christchurch,
New Zealand. Phone (03) 79 5570
Price includes postage & packing.

DEL TRAIN CONTROLLER project
con Chip November 1990, $19.95 plus
50 p&p. Plugpack, 12VAC, 1.7A, suitable
the above (use rectifier), $29.95 plus
00 p&p. Kits built & repaired. Prototype
duction board supplier to the hobbyist &
plier of SILICON CHIP project PCBs.
ECTRONIC TOY SERVICES, PO BOX
91, NOARLUNGA CENTRE, SA 5168.
Phone: (08) 382 8919

FIX-A-KIT

$20.00 PER HOUR LABOUR
3 MONTHS WARRANTY ON REPAIRS
12 MONTHS WARRANTY ON CONSTRUCTION
Service to most types of electronic equipment
TECHNICAL ASSISTANCE

HYCAL INSTRUMENTS
Design, Manufacture & Repair of Electronic Equipment
Trading Hours 8am to 3pm, Monday to Friday
(02) 633 5897

For more information, send a 43c
np to: Don McKenzie, 29 Ellesmere
scent, Tullamarine 3043.

SALE: 5mW LASER. Fully built
er supply. $350. (02) 728 4768.

ANTIQUE RADIO

IQUE RADIO restorations. Your
stop electronic repair shop. Spe-
sing in restoring vintage radios in-
ng chassis rewiring, quality new
, valves, valve sockets, speakers,
formers, cabinet restoration. Qual-
econdhand radio dials & parts for
brands & models. About 400 ra-
in stock for restoration & parts.
Every restored wireless is covered by a 2-year warranty on parts & service. French polishing of timber cabinets available. Vintage car radios in valve & transistor types available for restoration. Repairs done on tape decks, amplifiers, TVs & videos. Open Sat. 10am-5pm; Sun. 12.30-5pm. 109 Cann St, Bass Hill, NSW 2197. Phone (02) 645 3173 BH or (02) 726 1613 AH. SC

CREATE YOUR OWN DIGITAL WAVEFORMS

As described in *SILICON CHIP* in March 1990, May 1990 & June 1990. The software can also be used for the similar project (Simple PC Function Generator) described in *Electronics Australia* in January 1989.

Software & PC Board: $39.95 incl. p&p. Software only: $32.50 incl. p&p.

Money Order or Cheque. Guaranteed delivery within 14 days.

M. Radvanyi, PO Box 49, Kingswood, NSW 2749.

ing Feedback with Equalisation", p106, August 1990). I have decided to take your advice on frequency shifting the whole signal slightly with a "Howl Round Stabiliser", though the pitch shifting chips (MC1495) are rather hard to find. (S. P., Melville, WA).

• We have not considered doing an expander although the circuit is not much different from that of the compressor. We'll put it on the list of projects for 1991. How about that?

The Motorola MC1495 should be available from VSI Electronics (Australia) Pty Ltd in Perth. Try them on (09) 328 8499.

Volume control needs better matching

I have built two Studio 200 Stereo Control Units, as described in the June and July 1988 issues of SILICON CHIP. Both work well but they both have the same problem. When I want to listen at very low levels, when the rest of my family is asleep, I find that one channel is louder than the other. Is there a design fault in the circuit or is there a modification I can make to improve the problem? (M. K., Stanmore, NSW).

• What you are experiencing is not a design fault but the normal lack of matching between sections of the volume control when it is set at very low levels. Just about all controls on stereo amplifiers have the same problem unless a higher cost, specially matched volume control has been installed.

Japanese firms such as Alps do manufacture closely matched dual ganged volume controls but they are not cheap or readily available. It might also be possible to purchase such a volume control as a replacement part for a Japanese amplifier.

One other way around the problem would be to put in an extra switch to reduce the gain for low level listening, similar to a Mute switch. That way, you could listen at low levels but have the volume control set to say, 9 or 10 o' clock, where the control matching is reasonable. This could be achieved by switching a 22kΩ resistor in series with each section of the Balance control.

Another way could be to wire one pair of the Source inputs for lower gain. If you listen to CD most of the time, connect a 120kΩ resistor from the CD input to the Aux 2 input, in each channel. Then when you select Aux 2, you can listen to CDs with a higher setting on the volume control.

SILICON CHIP BINDERS

To: Silicon Chip Publications, PO Box 139, Collaroy Beach, NSW 2097, Australia.

Yes! Please send me _____ SILICON CHIP binder(s) at $A11.95 plus $A3 p&p each (NZ $A6 p&p).

Enclosed is my cheque/money order for $_____ or please debit my

❑ Bankcard ❑ Visa Card ❑ Master Card

Card No. | | | | | | | | | | | | | | | | |

Signature_____ Card expiry date_____/_____

Name _____

Street _____

Suburb/town _____ Postcode_____

Advertising Index

Altronics 52-53
Arista 17,74,97
Back Issues 58,59
Boston Technology 89
Cad Connection 102
Christian Blind Mission 97
David Reid Electronics ..... IFC,
Dick Smith Electronics 5-
EEM Electronics 103
Electronic Solutions 25,8
Electronic Toy Services 103
Electronics World 75
Elmeasco 2
Geoff Wood Electronics 1
Harbuch Electronics 3
Hycal Instruments 10
Jaycar Electronics 33-3
69-7
Jiloa 10
J.V. Tuners 7
M. Radvanyi 10
Oatley Electronics 5
PC Computers 10
PC Marketplace ..... IBC
Pelham 10
RCS Radio 7
Resurrection Radio 4
Rod Irving Electronics 44,4
60,61,90,9
Sheridan Electronics 1
Silicon Chip Binders ..... OB
Subscriptions 9
Sound Australia 1
Transformer Discounters 10

PC Boards

Printed circuit boards for SILICO CHIP projects are made by:

• Electronic Toy Services, 2/1 Glynville Drive, Hackham West, S 5163. Phone (08) 382 8919.

• Jemal Products, 5 Forge S Welshpool, WA 6106. Phone (0 350 5555.

• Marday Services, PO Box 19-18 Avondale, Auckland, NZ. Phone 5730.

• RCS Radio Pty Ltd, 651 Fore Rd, Bexley, NSW 2207. Phone (0 587 3491.

SUPER SPECIALS

BRAND NAME 360K 5.25" DISK DRIVES WITH 3 MONTHS WARRANTY

● 1 FOR $69 ● 2 FOR $120 ● 3 FOR $165 ● 4 FOR $200

FLOPPY DISK CONTROLLERS TO SUIT AT ONLY

Will support up to 2 drives of 360/720/1.2/1.44 includes cables for both 5.25" and 3.5" drives

NORMALLY $99.00 SUPER SPECIAL $49.00

SAVE $50.00 HURRY LIMITED STOCKS

MOTHERBOARDS

		WAS	NOW
088	12Mhz	$129.00	$109.00
088	12Mhz 640K installed	$250.00	$199.00
088	12Mhz 1Mb installed	$300.00	$235.00
088	31Mhz	$225.00	$189.00
088	31Mhz 640K installed	$335.00	$279.00
088	31Mhz 1Mb installed	$385.00	$319.00
0286	12Mhz	$350.00	$299.00
0286	16Mhz NEAT	$649.00	$449.00
0386	25Mhz Cache	$1995.00	$1495.00
0386	33Mhz Cache	$2495.00	$1795.00
0486	25Mhz Cache		$4395.00

CASES

	WAS	NOW
XT Case 4 Drives 150W P/S	$199.00	$149.00
AT Case 3 Drive 200W P/S	$299.00	$250.00
Minitower Case 200W P/S	$399.00	$299.00
Maxitower Case 200W P/S	$499.00	$399.00

EXTERNAL FLOPPY DISK DRIVES

		WAS	NOW
5	880K Macintosh series	$349.00	$329.00
25	164K Apple 11E	$249.00	$209.00
25	164K Apple 11Gs	$269.00	$229.00
5	720K Amstrad PC 1512/1640	$269.00	$249.00
5	1.44 Amstrad PC 2000	$329.00	$309.00
25	360K Amstrad PC 2000	$329.00	$249.00
25	1.2 Amstrad PC 2000	$329.00	$249.00
25	1.2 Amstrad Portable	$399.00	$379.00
5	720K Atari St	$269.00	$249.00
25	360K/720k 40/80 Atari ST	$299.00	$279.00
5	880K Amiga 500/1000/2000	$199.00	$185.00
25	360K Amiga 500/1000/2000	$299.00	$285.00
5	720K IBM	$299.00	$249.00
5	1.44 IBM	$329.00	$299.00
25	360K IBM	$299.00	$249.00
25	1.2 IBM	$329.00	$299.00
25	1.2 IBM PS11	$449.00	$409.00
25	360K Toshiba/portables	$349.00	$309.00
25	1.2 Toshiba/portables	$399.00	$369.00

POWER SUPPLIES

50W XT Power Supply	WAS	$125.00	NOW $99.00
00W AT Power Supply	WAS	$199.00	NOW $149.00

MONITORS/PRINTERS

	WAS	NOW
14" White/Amber/Green	$239.00	$205.00
14" Philips CGA	$535.00	$499.00
14" Multisync VGA	$899.00	$849.00
14" Colour VGA	$695.00	$649.00
Olympia NP30 Centronics	$499.00	$399.00
Olympia NP80/24 Centronics	$779.00	$699.00
Olympia NP136/24 Centronics	$1395.00	$999.00

MEMORY CARDS

	WAS	NOW
Memory card PC/XT 576k	$ 99.00	$79.00
Memory card 2Mb AT	$245.00	$199.00
Memory card 2Mb XT	$245.00	$199.00
Memory card 32Mb XT/AT	$299.00	$279.00
Ram card for Amiga	$199.00	$149.00

We also stock a huge range of cables, adaptors, swithboxes and chips
Call today for very competitive pricing.

MOUSE/ACCESSORIES

	WAS	NOW
Mouse for PC/XT/AT/PS11	$119.00	$99.00
Mighty Scanner	$399.00	$379.00
Sound Blaster	$399.00	$349.00

KEYBOARDS

101 Enhanced keyboard WAS $109.00
NOW $89.00

CONTROLLER CARDS

	WAS	NOW
FDC 360/720/1.2/1.4 x4	$129.00	$99.00
FDC 360K to 2.88Mb X4	$199.00	$179.00
FDC 360K INT/EXT x4	$55.00	$39.95
FDC 360/720/1.2/1.4 x2	$99.00	$79.00
HDC MFM PC/XT	$139.00	$99.00
HDC/FDC MFM PC/XT	$175.00	$149.00
HDC/FDC MFM AT	$245.00	$199.00
HDC MFM AT	$220.00	$199.00
Co-Existant FDC 2 Drives	$119.00	$99.00

INTERNAL FLOPPY DISK DRIVES

		WAS	NOW
3.5HH	720K	$199.00	$160.00
3.5HH	1.44	$199.00	$169.00
3.5HH	4MB	$299.00	$265.00
5.25	360K	$149.00	$69.00
5.25	1.2	$179.00	$149.00

INTERFACE CARDS

	WAS	NOW
Serial I/O Card 4 port	$199.00	$179.00
Serial I/O Card 8 port	$449.00	$429.00
Games card 2 port	$ 29.50	$25.00
Parallel printer card	$ 24.95	$19.95
Serial 2 port XT	$ 55.00	$35.00
Serial 2 port AT	$ 65.00	$40.00
Serial/Par/Games XT/AT	$125.00	$62.50
2Serial /2Parallel	$ 75.00	$50.00
Multi I/O S/P/G/C/F XT/AT	$125.00	$99.00
Proto Board with decoder	$149.00	$99.00
Slot Extension Kit	$199.00	$149.00

GRAPHIC CARDS

	WAS	NOW
Mono PC/XT/AT	$109.00	$69.00
CGA	$109.00	$99.00
VGA 8 bit	$249.00	$199.00
VGA 16 bit 256K	$349.00	$225.00
VGA 16 bit 512K	$449.00	$299.00

DEALER ENQUIRIES WELCOME ——

WRITE OR PHONE FOR FREE CATALOGUE

TRY PC MARKETPLACE SUPERFAST MAILORDER — PHONE OR FAX TODAY!

Phil Gleeson's **PERSONAL COMPUTER MARKETPLACE Pty Ltd**

PHONE (02) **418 6711**
FAX (02) 418 6713
Mail Order Address:
P.O. Box 1100 Lane Cove
NSW 2066

FREIGHT CHARGES
Include $10 with order for all normal items - heavy items, e.g. monitors add $15.
14 day money back guarantee
Order by phone (use credit card), by fax or by mail.
Unless insurance is declined it will be charged at 1% of total purchase. This is for your protection.
PRICES CURRENT FOR MONTH OF PUBLICATION OR WHILE STOCKS LAST.

VISA MasterCard

PC MARKETPLACE

● SERVICE IS THE DIFFERENCE ● SERVICE IS THE DIFFERENCE ● SERVICE IS THE DIFFERENCE ● SERVICE IS THE DIFFERENCE

ICON CHIP BINDERS

AVAILABLE NOW

- ★ High quality
- ★ Holds up to 14 issues
- ★ 80mm internal width
- ★ Gold printed with SILICON CHIP logo on spine and front cover

These beautifully made binders will protect your copies of SILICON CHIP. We are especially pleased with their look and quality. As soon as the first batch came in, everybody on our staff wanted them to store their own personal issues. You will too.

Made with a distinctive two tone green high-quality vinyl specially selected for SILICON CHIP, and with heavy board covers, each binder holds a year's issues (the 14 issues of Vol.1 or the 12 issues of Vol.2). They will look really smart on your bookshelf.

HOW TO ORDER:

Phone (02) 979 5644

Fax (02) 979 6503

To order your binders, fill in the coupon on page 104 and send it to SILICON CHIP, PO Box 139, Collaroy Beach, NSW 2097. Alternatively phone (02) 979 5644 and quote your credit card details, or fax your orders to (02) 979 6503. Price $A11.95 plus $A3 each for postage and packing. (NZ postage and packing $A6.)